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United States Department of Agriculture

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1989 Report on USDA Human Nutrition Research and Education Activities

A Report to Congress

PREFACE

This report was prepared under the auspices of the USDA's Subcommittee for Human Nutrition, Research and Education Committee of the Secretary of Agriculture's Policy and Coordination Council.

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Agency Abbreviations

Agency	Agency Abbreviation
Agricultural Marketing Service	AMS
Agricultural Research Service	ARS
Agricultural Stabilization and Conservation Service	ASCS
Cooperative State Research Service	CSRS
Competitive Research Grants Office	CRGO
Economic Research Service	ERS
Extension Service	ES
Food and Nutrition Service	FNS
Food Safety and Inspection Service	FSIS
Human Nutrition Information Service	HNIS
National Agricultural Library	NAL
Office of Public Affairs	OPA
Office of Grants and Program Systems	OGPS
Office of International Cooperation and Development	OICD

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EXECUTIVE SUMMARY

Introduction

In accordance with the provisions of section 1452(b) of the National Agricultural Research, Extension and Teaching Policy Act Amendments of 1985 (7 U.S.C. 3173 note) this report on the human nutrition research and education activities of the Department of Agriculture for FY 1989 is hereby submitted. Emphasis is placed on directions and highlights with no effort made to restate the Department's detailed plan, which was outlined in a report submitted in 1986.

Contents of Report

New human nutrition research projects initiated and research highlights during FY 1989 are presented for USDA agencies by six research areas:

- o Normal Requirements for Nutrients
- o Role of Nutrition in Health Promotion and Prevention of Diet-Related Disorders
- o Food Composition and Nutrient Bioavailability
- o Food and Nutrition Monitoring Research
- o Food and Nutrition Information and Education Research
- o Research on Government Policies and Socioeconomic Factors

The Food and Nutrition Information and Education programs within USDA also are summarized by new initiatives and ongoing programs to meet their clients needs. During FY 1989, improved communication exchange and cooperation among agencies on information and education activities was strengthened.

Human nutrition research and education activities in USDA continued to be linked with the nutritive value of foods, human nutritional needs, the kinds and amounts of foods that Americans consume relative to their needs, and strategies for improving diets and the food supply. The major role of USDA is to help individual consumers understand the relationship of food and its nutrients to maintaining health and preventing diet-related disorders during the different stages of life.

Funding Levels

The actual or estimated expenditures for human nutrition research and human nutrition information and education by the several USDA agencies for fiscal years 1985 through 1990 are given. The total amount of human nutrition research support by USDA has increased from $52.3 million in FY 1985 to $65.5 million in FY 1990, an increase of 25.2 percent. During the same period, USDA support for human nutrition information and education has increased from $133.6 million to $167.8, an increase of 25.6 percent. Most of the funds for information and education activities were distributed to and managed by State agencies. The total USDA support for human nutrition in FY 1989 was $210.4 million and is estimated to be $233.3 million in FY 1990.

Coordination

Continued progress was made during FY 1989 in achieving coordination within the Department of Agriculture, with other Departments, and with the private sector, thus helping to provide the best services possible within available resources. Specific recommendations made by outside advisory groups are also included.

1989 ANNUAL REPORT ON USDA HUMAN NUTRITION RESEARCH AND EDUCATION ACTIVITIES

A REPORT TO CONGRESS

I. INTRODUCTION

A. Charge

In accordance with the provisions of section 1452(a) of the National Agricultural Research, Extension and Teaching Policy Act Amendments of 1985 (7 U.S.C. 3173 note), a U.S. Department of Agriculture (USDA) comprehensive plan for implementing a national food and human nutrition research and education program was submitted to Congress in December 1986. Section 1452(b) of this Act requires the Secretary annually thereafter to submit a report on the human nutrition research activities conducted. Such reports, prepared under the auspices of USDA's Subcommittee for Human Nutrition, Research and Education Committee of the Secretary's Policy and Coordination Council, have been submitted for fiscal years 1987 and 1988. This report covers the Department's activities in human nutrition research and education for fiscal year 1989. As before, emphasis is given to new directions and accomplishments during the year. The 1986 report gives the detailed program plan components.

B. Legislative

1. Hunger Prevention

The Hunger Prevention Act of 1988 (P.L. 100-435) requires USDA to provide technical assistance to States and local agencies involved in gleaning--the gathering of leftover crops from the fields, for donation to the poor and hungry. The Extension Service was charged with the responsibility of providing this technical assistance. A packet of materials was developed which provided general information on how to start gleaning programs, a fact sheet on gleaning, technical assistance from a national network, citations of State laws limiting liability of food donors, and a background report on this activity. The packet was made available to various organizations throughout the country who expressed an interest in gleaning activities.

2. Special Supplemental Food Program for Women, Infants and Children (WIC)

P.L. 200-460 requires all WIC State agencies to examine the feasibility of implementing cost-containment systems, such as procuring infant formula through rebate systems.

P.L. 100-690 requires that the WIC Program provide information on the dangers of drug abuse and refer program participants to drug abuse counseling and treatment programs. In support of this responsibility, USDA is directed to conduct a study of appropriate methods for drug abuse education, prepare drug abuse education materials for distribution to State agencies, and appoint experts in drug and alcohol abuse education to the National Advisory Council on Maternal, Infant and Fetal Nutrition.

P.L. 100-435 authorizes up to 10 Farmers' Market Coupon Demonstration Projects for a 3-year period to provide WIC participants with coupons that they can redeem for fresh, unprepared foods at authorized farmers' markets. The purpose of the projects is to provide resources to persons at nutritional risk and to expand the awareness and use of farmers' markets.

P.L. 100-435 defines "homeless individual" and requires WIC State agencies to: (1) describe in their State Plans how they will provide benefits to and meet the special nutrition needs of the homeless; (2) announce program availability and distribute WIC information to organizations serving the homeless and to shelters for victims of domestic violence; and (3) have WIC-competent professional authorities take into account the special needs and problems of the homeless in prescribing program food packages. P.L. 100-435 also authorizes WIC State agencies to adopt methods of delivering benefits to accommodate the special needs and problems of homeless individuals.

3. School Breakfast

P.L. 99-500 mandated nutritional improvements in the School Breakfast Program and the extension of "Offer Versus Serve" to breakfasts. This change required that an additional food item be added to the school breakfast menu, and authorized schools to implement the "Offer Versus Serve" option in breakfast.

4. Commodities Scientific Support Division

The newly established Commodities Scientific Support Division (CSSD) of the Agricultural Marketing Service (AMS) provides centralized scientific and specialized marketing support to the Agency. The analytical laboratories of AMS are now consolidated within CSSD, a reorganization which enables the Agency to improve resource management, standardize methodologies, provide better service, and create a more challenging and safer workplace for employees. The laboratories perform: microbiological and chemical testing of processed dairy products, egg products, meat, poultry and poultry products, processed fruits and vegetables, and other food products in support of grading, certification, acceptance, and regulatory programs; and testing of peanuts and other commodities for aflatoxin. The Division also carries out quality assurance and safety oversight activities with respect to AMS laboratories and related testing activities.

5. Report on Year 2000 Health Objectives

The House Appropriations Committee Report concerning the 1989 appropriation to the Agricultural Research Service (ARS) contained the following:

> "Human Nutrition Research--Since the Department, through the Human Nutrition Information Service, is the Federal government's lead agency on nutrition matters, the Committee will expect the Department using its human nutrition research centers, to prepare a report prior to the fiscal year 1990 appropriation hearings regarding work done thus far with respect to nutrition matters in the Year 2000 Health Objectives study conducted by the Department of Health and Human Services. The centers should review the testimony and material presented at the various public

hearings regarding this study for comparison with current verifiable scientific conclusions on human nutrition. The centers should also review the methodology of preparing the final report along with the data supporting the report's recommendations."

Accordingly, an ARS ad hoc task group on Year 2000 Health Objectives was formed. This task group reviewed available material and submitted a report to Congress in early March as directed. The report was entitled "Process and Progress in Development of the Year 2000 Health Objectives Relating to Nutrition."

6. Nutrition Monitoring

The "National Nutrition Monitoring and Related Research Act of 1989" (S. 253 and H.R. 677), if enacted, will have considerable effect on the Agency's program. The act requires the Secretaries of the U.S. Department of Agriculture (USDA) and the Department of Health and Human Services (DHHS) to develop a comprehensive plan for monitoring with numerous components, to establish an advisory council, to jointly publish a dietary guidelines report every 5 years, and to review and approve all dietary guidance prior to publication, with provision for a public comment period on such guidance if disapproved by either Secretary. An alternative bill, the "Comprehensive National Nutrition Monitoring System Act" (H.R. 1608), also requires joint efforts by USDA and DHHS to strengthen the National Nutrition Monitoring System. It calls for annual reports to Congress and periodic evaluation by the Government Accounting Office, but does not call for an advisory council. The bill provides for a single-Secretary veto of proposed dietary guidance.

C. Changes in Resources or Infrastructure

1. Special Supplemental Food Program for Women, Infants, and Children (WIC)

Funds generated through cost containment efforts initiated by WIC State agencies, especially infant formula rebates which have been quite substantial, are having a significant impact on the program. Currently, 44 of 87 State agencies have implemented cost containment programs pursuant to P.L. 100-237. These savings, plus steadily increasing appropriations (from fiscal years 1985 to 1988, WIC has experienced a 20 percent increase in appropriation levels), have caused a major growth spurt in the program. In April 1989, there was a total of 4,167,476 participants. It is projected that current services, appropriation levels and ongoing cost containment efforts will support participation levels of over 4.4 million in fiscal year 1990.

o Drug Abuse Information

The mandate requiring the WIC Program to provide drug abuse information and referrals for counseling and treatment authorizes an amount, not to exceed $10 million, to be used for this purpose in fiscal year 1989, and amounts as appropriate for subsequent fiscal years.

o Farmers' Market Coupon Demonstration Projects

The mandate requiring WIC to carry out Farmers' Market Coupon Demonstration Projects authorizes that the following amounts be appropriated for this purpose: $2 million for fiscal year 1989; $2.8 million for fiscal year 1990; and $3.5 million for fiscal year 1991.

2. Aquaculture and Alternative Products Analysis Section

In FY 1989, the Economic Research Service (ERS) created the Aquaculture and Alternative Products Analysis Section. One of the chief products of this section is the Aquaculture Situation and Outlook Report. The report is published twice a year, in October and April. Aquaculture is defined as the production of aquatic plants or animals in some type of controlled environment for all or part of their life cycle. In 1988, U.S. aquacultural production was estimated at 790 million pounds with an estimated value of $600 million. The four largest segments of the domestic aquaculture industry are catfish, crayfish, trout, and salmon.

II. HUMAN NUTRITION RESEARCH ACTIVITIES

A. General

Human nutrition research and education in USDA traditionally has been linked with the nutritive value of foods, human nutritional needs, the kinds and amounts of foods that Americans consume relative to their needs, and strategies for improving diets and the food supply. A major effort in the USDA is to understand the relationship of food and its nutrients to health promotion in individuals at all stages of life.

The application of new nutritional knowledge often leads to changes in kinds and amounts of foods people consume, and hence often the demand for food. Similarly, any improvement of the nutritional quality of the foods we eat must involve corresponding changes in the agricultural food system. Hence, the nutrition of individuals or of population groups depends on a host of factors that occur in the "food chain" before food becomes available for consumption, i.e., during production, processing and storage, and marketing. To ensure an adequate supply of high quality foods, an intimate knowledge of food composition, of the biological effects of food constituents, and of nutritional requirements and tolerances of humans is needed. This knowledge can be derived only through interdisciplinary efforts, interfacing nutrition research with pre- and post-harvest agricultural science and technology.

The human nutrition research activities during FY 1989 are presented under six areas as detailed in the national plan. These are:

- Normal Requirements for Nutrients
- Role of Nutrition in Health Promotion and Prevention of Diet-Related Disorders
- Food Composition and Nutrient Bioavailability
- Food and Nutrition Monitoring Research
- Food and Nutrition Information and Education Research
- Research on Government Policies and Socioeconomic Factors

It is important to note that the USDA research activities also fit well into the Federal 5-Year Plan, released by the Interagency Committee on Human Nutrition Research (ICHNR) in 1986. The USDA does not conduct research on the role of nutrients in the treatment of chronic diseases or disorders. It does, however, support some research on health promotion or prevention of nutrition-related disorders, especially as related to fats, fiber, and complex carbohydrates and other components of foods and diets. The USDA program focuses especially on normal nutrient requirements and content and bioavailability of nutrients in foods.

A computer search was made on November 28, 1989, of ongoing research in USDA relating to human nutrition, using the Human Nutrition Research Information Management System (HNRIMS). Table 1 shows the number of USDA research projects in most of the nutrition code categories under each of the six research areas listed. The table also shows the percentage of the total number of USDA projects that were coded for each of the categories. In addition, the percentage of the total number of research projects in HNRIMS for all Federal agencies which are USDA supported projects, is given by nutrition code category. The USDA projects include those conducted by the USDA agencies, the State Agricultural Experiment Stations, and the 1862 and 1890 land grant institutions and Tuskegee University. Some of these projects receive no Federal funds. The total Federal funds expended by USDA for human nutrition research in FY 1989 was $61.8 million (see Table 2, Section IV).

The Agricultural Research Service is the principal intramural research agency of the Department. Its research in human nutrition is conducted largely at five separate Human Nutrition Research Centers and at Regional Research Centers. The Centers maintain close communication with each other and the research programs are coordinated through the National Program Staff. Each Center has a different research thrust and provides its unique contribution in solving high priority national problems. The locations and primary missions of the ARS Human Nutrition Research Centers are listed:

Beltsville Human Nutrition Research Center, Building 308, BARC-East, USDA-ARS, Beltsville, Maryland 20705; Dr. Walter Mertz, Director, 301/344-2157. Its history can be traced to 1894 at Wesleyan University at Middletown, Connecticut. A move was made to Washington, D.C. in 1906 and to Beltsville, Maryland in 1941. Research is conducted on nutrient composition and nutritional qualities of food. Studies are performed on energy metabolism and nutritional requirements. Dietary strategies are developed which can delay the onset of nutritionally related chronic diseases.

Grand Forks Human Nutrition Research Center, P.O. Box 7166, University Station, USDA-ARS, Grand Forks, North Dakota 58202; Dr. Forrest Nielsen, Director, 701/795-8456. It was established in 1970. The focus is on defining human requirements for trace elements and the physiological and biochemical factors which influence those requirements.

Western Human Nutrition Research Center, P.O. Box 29997, USDA-ARS, Presidio of San Francisco, California 94129; Dr. James Iacono, Director, 415/556-9697. It was established in 1980. Improved methods are developed for monitoring and evaluating nutritional status and factors that lead to malnutrition are investigated. Studies on human nutritional requirements are conducted.

Human Nutrition Research Center on Aging at Tufts University, USDA-ARS, 711 Washington Street, Boston, Massachusetts 02111; Dr. Irwin Rosenberg, Director, 617/556-3330. It was established in 1979. Research is conducted on the special nutritional needs of persons as they age with a view toward enhancing the quality of later life through improved nutrition and health.

Children's Nutrition Research Center, 1100 Bates Street, USDA-ARS, Houston, Texas 77030; Dr. Buford Nichols, Director, 713/798-7000. It was established in 1979. The focus is on determining the unique nutrient needs of pregnant and lactating women, and of children from conception through early years of development.

The Cooperative State Research Service (CSRS) is the Agency in the United States Government, that serves as an interface and coordinating mechanism between the United States Government research organizations, the 59 designated states and territorial agricultural experiment stations, and the 1890 Colleges and Tuskegee. Money is appropriated by Congress and administered by the Secretary of Agriculture through the Cooperative State Research Service to each of the stations on a formula basis. Before the states can spend the money, they submit projects which must be approved by CSRS for funding. The states have a large degree of freedom in spending the money other than submitting projects for approval and submitting annual progress reports. National research priorities are recommended by the state experiment directors to the Department of Agriculture and then incorporated into the Department's annual request for funds from Congress.

Six regional research projects typify areas of nutrition research currently underway at state agricultural experiment stations. These are: (1) Nutrient Bioavailability, which involves the cooperative efforts of ten states and the Agricultural Research Service (ARS); (2) Health Maintenance Aspects of Dietary Recommendations Designed to Modify Lipid Metabolism, which involves ten states and ARS, deal directly with the nutrition aspects of individual's health and well-being; (3) Communication Strategies to Improve Nutritional Practices of Adolescents (5 states); (4) Nutritional Assessment in Older Adults: Diet Intake and Biochemical Studies (9 states and ARS); (5) Economic and Behavioral Factors Associated with Food Supplement Usage (8 states and ARS); and (6) Improving Sensitivity of Methods to Assess Nutrient Intake and Predict Nutritional Risk (6 states). These regional projects deal with problems and opportunities to bring about the use of better nutritional practices in the general population.

In addition, there are numerous individual research projects which encompass the entire spectrum of nutrition research. A recent development is the establishment of a Human Nutritional Research Center at Iowa State University. CSRS also administers the Competitive Research Grants Program in human nutrition through its Competitive Research Grants Office.

Table 1. USDA Research in Human Nutrition
(from HNRIMS, November 28, 1989)

HNRIMS Nutrition Code Area	USDA Projects* Number	USDA Projects* %	USDA Projects as % of Federal Research in Area
Normal Human Requirements for Nutrients			
1. Maternal	48	4.8	23
2. Infant and Child	58	5.8	16
3. Adolescent	20	2.0	23
4. Adult	83	8.3	57
5. Elderly	37	3.7	23
10. Immunology, Nutrition & Infection	16	1.6	12
12. Genetics and Nutrition	29	2.9	11
13. Nutrition and Function	130	12.9	35
14. Nutrient Interactions	133	13.2	28
15. Other Conditions & Nutrition	46	4.6	8
Role of Nutrition in Health Promotion and Prevention of Diet-Related Disorders			
6. Cardiovascular Disease and Nutrition	60	6.0	11
7. Cancer	37	3.7	7
8. Other Diseases (Osteoporosis, Diabetes)	34	3.4	6
9. Trauma & Nutrition	5	0.5	17
11. Obesity, Anorexia and Appetite Control	33	3.3	9
17. Carbohydrates	89	8.9	39
18. Lipids	176	17.5	29
19. Alcohols	3	0.3	4
20. Proteins and Amino Acids	145	14.4	33
21. Vitamins	116	11.5	21
22. Minerals and Trace Elements	179	17.8	37
23. Water and Electrolytes	19	1.9	15
24. Fiber	44	4.4	57
25. Other Nutrients in Foods	69	6.9	51
Food Composition and Bioavailability of Nutrients			
26. Food Composition	272	27.1	80
27. Bioavailability of Nutrients	124	12.4	73
28. Effects of Technology on Nutritional Characteristics of Food	276	27.5	91
29. Other Food Science Research	90	9.0	76
Food and Nutrition Monitoring Research			
16. Nutritional Status	166	16.5	45
30. Food Consumption Surveys	56	5.6	70
31. Dietary Practices, Food Consumption Patterns	134	13.3	41
Food and Nutrition Information and Education Research			
32. Methods for Informing Public About Nutrition	35	3.5	44
33. Other Nutrition Education Research	22	2.2	54
Effects of Gov. Policy and Socioeconomic Factors			
34. Effects of Gov. Policy and Socioeconomic Factors on Food Consumption and Nutrition	48	4.8	86

*Numbers are not additive as projects may be assigned more than one nutrition code (1,004 USDA research projects in system).

B. Normal Requirements for Nutrients (ARS, CSRS)

1. Competitive Research Grants Program

The Human Nutrient Requirements Program of the Competitive Research Grants Office, CSRS, awarded $948,000 in grant support for 11 projects in FY 1989. The findings will increase our understanding of requirements for nutrients and help fill the gaps about nutrient bioavailability, nutrient interrelationships and the nutritive value of foods consumed with different patterns of intake in the U.S. The following projects were funded in FY 1989:

- Thyroid Hormone Metabolism in Iron Deficiency Anemia, $70,000/2 years.
- Comparison of Nutrient Intake and Growth of Breast vs. Formula-Fed Infants, $90,000/2 years.
- The Pre-Ruminant Calf as a Model for the Study of Human Carotenoid Metabolism, $120,000/2 years.
- Alteration of Immune Development by Gestational Zinc Deprivation. $50,000/1 year.
- Vitamin C and Cancer Prevention Through Inhibition of Endogenous Nitrosation, $139,000/2 years.
- Dietary Copper: Lipoprotein Synthesis Intracellular Processing and Secretion, $111,000/3 years.
- The Nutritional Essentiality of Pyrroloquinoline Quinone, $123,000/2 years.
- Boron Content and Isotope Ratio of Nutritional Samples: Preparation and Analyses, $23,000/1 year.
- Cholesterol Effect on the Expression of Viral Genes in Atherogenesis, $50,000/1 year.
- Exchangeability and Absorption of Calcium in Humans, $50,000/1 year.
- Metabolism and Function of Retinoic Acid in the Small Intestine, $122,000/2 years.

Findings made by selected investigators currently supported by the Human Nutrition Program of the Competitive Research Grants office are listed:

- Heat stable trypsin/chymotrypsin inhibitors have been identified in some cultivars of dry beans. Preliminary evidence suggests that these inhibitors may adversely affect the digestibility of the bean proteins.
- Ingestion of a threonine imbalanced diet in rats results in a depression of the limiting amino acid in the prepyriform cortex, an area of the brain essential for the anorectic response. In addition, norepinephrine activity may be increased after eating these diets.

- Breast fed infants have a lower growth velocity and energy intake at 6-12 months, but there are no apparent deleterious consequences.

- Humans fed a choline deficient diet for 3 weeks showed an increased rate of muscle fatigue when compared to those on a choline sufficient diet.

- Investigators have used an isotope dilution technique to assess total body stores of vitamin A. Poor vitamin A and vitamin E status was associated in Indonesian children.

- In mice, lactation results in heavier intestines, an increase in intestine luminal diameter, and an increase in carrier-mediated and non-mediated intestinal transport.

- The ratio of n-3/n-6 fatty acids, rather than the absolute amounts, appears to determine the degree of inhibition of arachidonic acid metabolism by dietary n-3 fatty acids in studies done in rats.

Results from ongoing intramural and other extramural research supported by USDA are given in the following sections.

2. Infants and Children

o Energy Needs of Breast-Fed and Formula-Fed Infants

Controversy persists regarding the adequacy of human milk as the sole source of energy for infants after the first few months of life. The quantities of milk produced by well-nourished women provide less energy than theory suggests that infants require for their optimal growth and development. In addition, human milk-fed infants consume smaller amounts of energy than the amounts of energy that formula-fed infants are reported to consume. Accordingly, a study was designed to compare energy utilization in human milk-fed and formula-fed infants at 1 and 4 months of age. The results indicated that 1-month-old, human milk-fed and formula-fed infants consumed similar amounts of energy, but that at 4 months, formula-fed infants consumed substantially more energy than human milk-fed infants. Although the formula-fed infants were somewhat larger at 4 months, there was no indication that the human milk-fed infants were adversely affected by their smaller energy intakes. It remains to be determined whether differences in energy intake may be contributed to differences in energy availability from human milk and formula, in body composition, or in energy expended in activity.

o Energy Intake Also Less for Older Breast-Fed Infants

Reduced energy intakes and weight gains after 4 weeks of age have been consistently observed for exclusively breast-fed infants as compared to those fed infant formulas. A study was performed to determine whether the *ad libitum* addition of solid foods to the diet would increase energy intakes and reverse the decline in weight noted in earlier studies. Volunteer mother/infant pairs were recruited from middle and upper income groups with

entry criteria including the intention to breastfeed exclusively for at least 16 weeks; 58 pairs entered and 45 pairs completed. Human milk intake declined after the addition of solid foods. Milk composition did not change during the observational period. No significant change occurred in energy intakes between the infants which were exclusively breast-fed and those which also were fed solid foods. The addition of solid foods had no effect on the reduced infant weight gain as reported in studies of exclusively breast-fed infants. Because unlimited nutrients were available from the solid foods, the explanation for growth performance cannot be attributed to external restrictions of energy. It appears, therefore, that the actual energy requirements of breast-fed infants over 4 weeks of age are substantially below current estimated requirements.

o Energy Cost of Growth During Infancy

In order to achieve healthy growth and development, human infants must consume an adequate amount of energy, as well as a balance of essential nutrients. The exact amount of energy required, however, is still in question. A study was designed to determine how much energy is needed for a healthy, term infant to grow. Results indicated that, for the 20 infants studied, 5.7 kilocalories were required for every gram (0.03 oz) of weight gained. This information is valuable to other researchers, nutritionists, pediatricians, and ultimately to parents of infants because it can help ensure that infants consume enough of the appropriate kinds of foods to enable healthy growth.

o Amino Acid Needs of Very Low Birth Weight Infants

Premature infants whose birth weight is very low require a special diet to counteract the physiological disadvantages of their early birth. Although researchers have identified some of the components needed in their diet, the exact substances and quantities that will promote consistent, rapid growth have not been completely identified. A study was done in which results of very low birth weight infants fed either their own mothers' milk fortified with skim and cream components derived from human milk or a standard cow milk-based infant formula were compared. There were significant differences in the levels of several plasma amino acid concentrations between the two groups. The results indicated, however, that neither of the two milk preparations is optimum for promoting rapid growth in premature infants.

o Method Devised to Extract Human Lactoferrin

Lactoferrin, a protein in human milk, is important in the development and maturation of healthy infants. It helps in the transport of iron and in the defense against bacterial invasion in the intestines. The mechanisms by which lactoferrin produces these beneficial effects are not completely understood, however, and large quantities of purified lactoferrin are necessary to study the protein and its functions. One-step purification by affinity-chromatography on single-stranded DNA-agarose was devised to remove

lactoferrin from human milk. This method, compared with others currently in use, is more rapid and provides a protein of higher purity. It will have considerable utility in providing necessary amounts of lactoferrin for further research into the structure and functions of this important protein for infants.

o Bone Mineralization in Very Low Birth Weight Infants

Bone mineral content in exclusively human milk-fed, very low birth weight infants is lower at 16 and 25 weeks after hospitalization than bone mineral content in similar infants who have been fed a commercial formula. A study was conducted to determine whether maturation and the introduction of solid foods would affect the rate of bone mineralization in infants previously fed only human milk. The results indicate that mineral deficits identified in these infants in the initial period after hospitalization were still present one year later, even after the addition of other foods, including routine commercial formula, to their diets. These results suggest that the initial period immediately following hospitalization may be the best time for very low birth weight infants to recover from accumulated bone mineral deficits. Based on these findings, bone mineralization evaluations throughout the first year for infants is important. Mineral supplementation of human milk for the infants in their initial post-hospitalization period also is indicated.

o Calcium and Phosphorus Deficiencies Studied in Neonatal Miniature Piglets

Little is known about the specific effects of different amounts of two dietary minerals, calcium and phosphorus, on the development of bone and muscle in early infancy. The infant miniature pig was chosen as an appropriate model for a study of human infant growth and development. Diets of three groups of piglets were either adequate, mildly deficient, or severely deficient in calcium and phosphorus. As expected, there was inadequate development of bone in the group fed a severely deficient mineral diet, but muscle development was similar among groups, regardless of diet. In addition, mineral analysis of the piglets was similar to that of third trimester human fetuses. Dietary Ca and P deficiencies affected P content of muscle less than that of bone.

o Zinc and Copper Absorption and Balance in Infants

Mineral requirements for infants are estimated from the amount consumed in breast milk and the percentage of that mineral actually absorbed. Although zinc and copper absorption from milk and milk products has been measured in animals, information on actual zinc and copper absorption by human infants has been lacking. Therefore, a study was conducted in which stable isotope tracers of zinc and copper were used to estimate their absorption by 3-month-old infants, with a novel method of collecting feces in metal-free diapers to measure zinc and copper excretion. Zinc absorption was 25 percent greater from breast milk than from infant formula, but copper absorption was similar from breast milk and formula. However, because infant formula is

fortified with zinc and copper, greater total amounts of these minerals are absorbed by formula-fed infants. Zinc intakes by both breast-fed and formula-fed infants were greater than the amount estimated to meet daily requirements, and percent zinc absorption was also greater than the minimum estimated to be necessary. Similar estimates for copper requirements of infants are not available; this study should be useful in making such estimates.

3. Maternal Nutrition

o Energy and Protein Intake and Lactation in Women

The regulation of lactation performance in the human is poorly understood. Although most lactation studies focus on milk production and composition or infant growth, it is also important to examine the effects of maternal diet and nutrient metabolism. The relationships among lactation performance, maternal diet, and body protein metabolism were determined at 1, 5, and 12 months postpartum in lactating women who consumed a controlled diet of measured protein and energy and received a primed constant infusion of nonradioactive stable isomer of leucine used as a marker of protein synthesis. In this study of healthy lactating women, both the quantity of milk produced and the concentrations of milk nitrogen were associated with the subjects' intakes of protein and energy, as well as their body protein metabolism. Milk production was associated positively with lysine flux, leucine incorporation into body protein, nitrogen intakes, and energy intakes. These observations document associations among lactation performance, maternal diet, and the metabolic responses of endogenous body nutrient stores in well-nourished women and suggest strategies for the improvement of milk production in settings where nutrient insufficiency and malnutrition prevail.

o Protein Requirement of Lactating Women

Lactating women who breastfeed their infants can maintain good health and adequate milk production only if they consume enough protein. The specific amounts of protein which these women must consume, however, are not known with certainty. Recommended amounts of dietary protein intake have been determined by several health and scientific organizations, both in the United States and in the world. All these organizations used the factorial method to estimate the safe level of dietary protein intake for lactating women; one gram (0.03 oz) of protein per kilogram (2.2 lb) of body weight per day. This estimate was tested using the nitrogen balance method, a more direct approach for the estimation of protein needs. It was found that lactating women, despite higher energy intakes, had lower nitrogen balances compared with those of nonlactating women. Urinary 3-methylhistidine excretion also was reduced suggesting that decreased skeletal muscle protein breakdown was a compensatory response to these levels of dietary protein in the lactating women. Current recommended dietary protein allowances may be insufficient to meet the nutritional needs of well-nourished lactating women.

o Fatty Acid Synthesis by the Human Mammary Gland

Variations in the fat composition and intake of a mother's diet alter the fat composition of her milk. Milk triglycerides, which consist of fatty acids of varying chain lengths, are the major components of human milk fat and are derived from three sources: mammary gland production, dietary fats, and body fat stores. A new method was devised which utilizes stable isotopic labeling to study the effects of low-fat and high-fat diets on fat production by the mammary gland and the attendant changes in milk fat composition. Low-fat diets compared with those high in fat resulted in milk that contained more medium-chain triglycerides. These studies are unique in human lactation research and illustrate the complex relationships among diet, energy metabolism, and milk composition. The primary fatty acids synthesized during lactation were saturated fatty acids with 10, 12, and 14 carbons in length but there was no major influence of diet on fat level.

4. Adult Nutrition

o Selenium in Hair and Nails--Poor Indicator of Status

The trace element selenium is being considered for use in large-scale human supplementation trials investigating cancer prevention. Before such studies can be carried out, however, suitable indices of selenium status must be available to monitor the large body pools of selenium. Previously, blood levels of selenium have been utilized, but this tissue does not always reflect the changes taking place in muscle and liver, which store much of the body's selenium. Hair and nails have been recommended for assessing selenium status because these tissues are non-invasively obtained, easily sampled, and conveniently transported, stored and analyzed. However, it has been found that in rats the amount of selenium deposited in hair and nails is strongly affected by the chemical form of selenium in the diet, as well as intake of the amino acid methionine. Therefore, consideration must be given to nutritional factors other than the amount of selenium in the diet when using hair and nails to monitor selenium status.

o Protein Needs Higher for Endurance-Trained Men

Indirect evidence has suggested people who exercise regularly may have a higher need for dietary proteins, but international health organizations have stated that although energy needs increase with activity, protein needs remain unchanged. Accordingly, dietary protein needs and protein metabolism were examined in 6 young (26.8 +/- 1.2 yr) and 6 middle-aged (52.0 +/- 1.9 yr) men who had regularly performed endurance exercise (running, rowing, cycling) for more than 2 years. They consumed 0.6, 0.9, or 1.2 grams of high quality protein per kilogram body weight per day over three separate 10-day periods while maintaining habitual exercise and constant body weight. In all men, the lowest protein intake led to daily nitrogen losses that exceeded nitrogen intake. Their protein requirement was estimated to average 0.94 grams/kilogram body weight per day with no effect of age. The rates of body protein synthesis and breakdown were measured using tracer methods. The values for body protein were similar in both age groups and similar to values reported for sedentary men. Similarly, the breakdown rate of contractile

proteins was not affected by age or physical activity. The protein needs of young and middle-aged endurance-trained men were greater than the Recommended Daily Allowance of 0.8 grams per kilogram body weight per day, but this was not associated with enhanced protein synthesis or breakdown.

o Vitamin C Needs of Nonpregnant Women

Information on the vitamin C requirement of women is limited. The current U.S. Recommended Dietary Allowance for vitamin C for men and women is 60 mg/day. In addition, a commonly used food additive, erythorbic acid, has been found in some animal studies to lower the tissue levels of vitamin C. Comparable studies with this food additive have not been conducted with people. The objectives were to study the requirement of the adult, nonpregnant female for vitamin C; to compare the usefulness of several laboratory procedures for evaluating vitamin C nutritional status; and to determine the influence of erythorbic acid on vitamin C metabolism and status. In this study, erythorbic acid did not present any adverse effects, but rather had a small "sparing-effect" on vitamin C metabolism. Based on the findings, vitamin C requirements for adult nonsmoking, nonpregnant women would be marginally met by an intake of 60 mg/day, whereas 90 mg/day would provide an allowance for body storage (Cooperator, H. Sauberlich, University of Alabama, Birmingham).

o Factors Affecting Copper Requirements

Recent findings with animal models suggest that copper deficiency may have a role in ischemic heart disease. And indeed, copper deficiency has been produced by ARS scientists in adult humans. However, a number of factors affect the nature and severity of the signs of copper deficiency. To investigate this, four experiments were performed to determine whether sulfur amino acid nutriture, sex, and genetic makeup of the rat affected its response to copper deficiency. The findings obtained confirmed the hypothesis that all three of these factors influenced the signs of copper deficiency. The mildest signs of copper deficiency occurred in rats fed a diet low in sulfur amino acids; the most severe signs of copper deficiency occurred in rats fed high amounts of the sulfur amino acid, cystine. Copper deficiency signs of anemia and depressed growth were more marked in males than in females. Copper deficiency-induced growth depression and heart weight increase were more marked in the Long-Evans strain than in the Sprague-Dawley strain of rats. The findings demonstrate that the sulfur amino acid composition of the diet, genetic makeup, and sex markedly affect the response to Cu deficiency.

o Copper Status Indices in Men and Women

Copper requirements and methods for assessing copper status in humans are poorly understood. Hence, indices of copper status were measured in eight men and eight women fed diets low in copper for periods ranging from 42 to 120 days. Three of the men and the women fed less than 0.9 mg Cu per day showed signs of copper depletion, including increased serum cholesterol, lower glucose tolerance, and blood pressure changes. One of the men had significant

changes in levels of plasma copper and superoxide dismutase, a copper-containing enzyme of red blood cells. Cytochrome oxidase in blood platelets and the enzymatic activity of blood ceruloplasmin were found to be sensitive indicators of copper status in the women. These data suggest that the human copper requirement is probably slightly above 0.90 mg per day and that sex differences need to be considered when determining the effect of copper on indices of copper status. These observations are useful for defining copper requirements and methods for evaluating copper nutrition in population surveys.

o Copper Needs of Young Men

The current tentative level of copper intake estimated to be adequate by the National Research Council is substantially higher than the usual intake of Americans, but signs of copper deficiency have not been observed in normal, healthy people. The estimated adequate daily intake was based on limited balance data. It is important to know whether this estimated need is higher than necessary or if most of the population is at risk of copper deficiency. Therefore, eleven young men were confined to a metabolic research unit for 90 days to determine the effect of the level of dietary copper (Cu) on Cu nutriture. The study was divided into three metabolic periods (MP), the first with an adequate Cu diet, the second with a low Cu (0.8 mg) diet, and the third with a high Cu diet. Three indices of Cu status, serum Cu, ceruloplasmin, and erythrocyte superoxide dismutase (SOD), were determined at intervals throughout the study. Urinary and salivary Cu were determined at the beginning of the study, and at the end of each diet period. Neither Cu status, urinary Cu, or salivary Cu differed. These results indicate that 0.8 milligrams of dietary Cu per day was adequate to maintain Cu status for at least 42 days in normal, healthy men. These results can help in establishing a more realistic estimate of the daily dietary copper needs in human adults.

o Nutritional Adaptation of Basketball Players to Training

A male college basketball team was studied over a season to determine the structural, functional and nutritional changes that occurred as a result of training. Preseason measurements of body composition, body type, treadmill running performance and plasma metals were compared to postseason measurements; the season was five months long. The group of eight players had a loss in fat-free weight of less than 1 kg, and a one-minute decrease in running time on the treadmill. More zinc appeared in the plasma after exercise, and this change was associated with a concomitant change in plasma copper, after training. This nutritional adaptation suggests a physiological adjustment to increase the efficiency of the cardiorespiratory response to exercise. The change in Zn mobilization and the concomitant change in Cu mobilization offer a unique finding to explain the nutritional adaptation to training. The findings provide the first indication of a significant change in nutritional status in response to exercise and training.

o Dietary Fiber and Plasma Constituents

High fiber diets have been reported to reduce risk factors for a number of diseases including heart disease, atherosclerosis, diabetes and cancer. Some

dietary ingredients are known to interact with fiber resulting in a decreased intestinal absorption of some essential minerals in human subjects. One component of foods known as oxalic acid also has been shown to reduce mineral levels in people when combined with a high fiber diet. Some foods such as spinach, rhubarb, parsley, and tea contain relatively high concentrations of oxalic acid. A study was done in which twelve men ate a low or high fiber diet with an average of 450 mg/day of oxalic acid from spinach for 12 weeks. Five minerals and cholesterol, triglycerides, uric acid, and glucose were measured in fasting plasma and correlated with fecal oxalate, mineral uptake and balance. Fiber level had no effect on the plasma constituents.

5. Elderly

o Nutritional Status and Cataract Formation

Previous animal studies have suggested an association between nutritional status and cataract formation in the lens of the eye. The formation of cataracts can lead to blindness in the affected eye. Therefore, the relationship between nutritional status and cataract formation was examined. Those nutrients believed to influence the len's ability to protect itself from the damaging effects of oxygen were studied. The subjects in this study were between 10 and 70 years of age. Seventy-seven subjects had a cataract in at least one lens. Blood levels were determined for many vitamins and minerals. The results suggested that the risk of cataract was reduced for subjects with the highest blood levels for vitamin D and carotenoids. Persons with cataracts were found to have lower values for vitamin C and higher values for vitamin B-6 and the mineral selenium. The results obtained are consistent with the idea that cataract formation may be delayed by nutrients that inhibit oxygen and accelerated by those nutrients that influence the activation of oxygen.

o Vitamin C Status and Nutrient Interactions in Healthy Elderly

As part of its mission to study the relationship between nutrition and aging, the USDA Human Nutrition Research Center on Aging at Tufts University carried out a survey of the nutritional status of healthy elderly in the Boston area. One purpose of the survey was to describe age- and sex-specific nutrient intakes, biochemical and anthropometric measures in free-living and institutionalized healthy elderly. Approximately 1,000 volunteer subjects were studied. This report focuses on the vitamin C status of the 677 free-living subjects for whom vitamin C intake and blood vitamin C data were available. Six percent of the males and 3 percent of the females showed marginal vitamin C status. Average plasma vitamin C levels were higher in the females compared to the males at all levels of vitamin C intake. Vitamin C supplement use was associated with higher blood levels for other vitamins including vitamins B-6, B-12, E, and folate for both sexes. Females also showed increased levels of vitamin A with increased intake of vitamin C. From the results of this survey, increased levels of vitamin C in elderly females appear to be associated with improved status of vitamin E and folate.

o Exercise and Aging

Increased physical activity in the elderly has been shown to increase life expectancy even into advanced old age. Normal age-related changes in body composition, including increased fat mass and decreased muscle and bone mass, may be due in part to decreasing physical activity. There is evidence that fat mass in physically active adults shows no increase with age per se but rather is indirectly related to amount of exercise. Changes in body composition associated with age and/or inactivity are associated with decreased glucose tolerance and a greatly increased risk for developing mature-onset diabetes. Research showed that 12 weeks of strength training 3 days per week by adults 60-72 years resulted in a marked increase in extensor and flexor strength. This increase in muscle strength was associated with an 11.4% increase in the total muscle size of the thigh. A progressive resistance training program also was used to condition the knee extensor muscle of a group of 10 institutionalized elderly men and women (mean age, 90 ± 3 years). Regular aerobic conditioning 4 days per week also causes significant improvement in VO_2 max in glucose-intolerant older subjects. Such training also improves glucose tolerance, insulin-stimulated glucose disposal rates, and muscle glycogen stores. These studies indicate that the capacity of skeletal muscle to adapt to an exercise intervention is preserved well into old age.

o Vitamin B-6 Deficiency Affects Insulin and Glucose in Elderly

The vitamin B-6 requirements of the elderly have been studied with four males and four females, 61 to 67 years old, who completed a 3-month study in a metabolic unit. The effects of B-6 nutriture on plasma glucose and serum insulin levels were studied, and glucose tolerance tests were conducted. The study protocol consisted of a 5-day baseline period, followed by 17 to 20 days of a B-6-deficiency period during which the subjects ingested a vitamin B-6-low diet. A person was considered B-6 deficient when the xanthurenic acid excreted in a 24-hour urine sample after a L-tryptophan load was 300 mg or more. Following the B-6-deficiency period, there were 3 stages of B-6 repletion, each lasting 21 days, during which the subjects ingested diets containing increasing amounts of vitamin B-6. Serum insulin levels were elevated during B-6 deficiency, and the increase was much greater in males than in females. Among males, but not females, an increase in plasma glucose also was observed during B-6 deficiency. The results of this study will help establish requirements for vitamin B-6 in the elderly.

o Seasonal Variation in Vitamin D Requirements of Aging Women

Currently there is no consensus on how to define the vitamin D requirement of the elderly. To develop a working definition of vitamin D adequacy, the relationship between vitamin D intake and serum concentrations of 25-hydroxyvitamin D (25(OH)D) and parathyroid hormone (PTH) was examined in 333 healthy postmenopausal women enrolled in a calcium supplement field trial. When serum 25 (OH)D concentration drops below 32 mg/ml, then a late winter increase in PTH concentration occurs. This seasonal increase in PTH has the potential to accelerate bone loss. The vitamin D intake required to

maintain an adequate 25(OH)D level and prevent the wintertime increase in PTH was found to be 220 IU daily for healthy ambulatory postmenopausal women. Subjects with altered absorption or metabolism of vitamin D will require higher intake. To the extent that seasonal increases in PTH adversely affect bone health, as is commonly thought, the recommended dietary allowance for vitamin D of 200 IU daily is too low.

o Assessment of Body Composition in Aging Individuals

An essential component in nutritional status assessment is the measurement of the body's fat-free mass (FFM) or lean body. One's ability, however, to accurately measure this compartment is limited in older individuals. Therefore, a study was undertaken to validate the total body electrical conductivity (TOBEC) technique for assessing FFM in middle-aged and elderly individuals. One hundred fourteen men and women between 35 and 90 years of age served as research volunteers. Each volunteer underwent body composition assessment using traditional methods as well as the TOBEC method. The findings of the project demonstrated a significant relationship between the TOBEC measures of conductivity and the other traditional methods of FFM assessment. It also was determined that the TOBEC method would be a better assessment of FFM in middle-aged and elderly people because it is not affected by changes in bone mineral content.

o Vitamin E Supplementation and Immune Response in Elderly

Supplementation of old mice with vitamin E and glutathione has been shown to improve immune responsiveness. Therefore, the effect of daily vitamin E supplementation (800 IU for 30 days) on immune responses of 32 healthy subjects (60+ years old) was examined in a double-blind trial in a Metabolic Research Unit. Delayed type hypersensitivity skin tests (DTH), mitogen-stimulated lymphocyte proliferation, as well as interleukin$_2$ (IL-2), prostaglandin E_2, plasma lipid peroxides, and other nutritional biochemistry profiles, were evaluated before and after treatment. In the vitamin E-supplemented group: (1) the vitamin E content was higher ($P<0.005$) in plasma and white blood cells than in the placebo group; (2) the cumulative score and number of positive antigens in DTH response were elevated; (3) the mitogenic responses to optimal doses of ConA were increased; (4) IL-2 formation in response to ConA increased and (5) PGE_2 and plasma lipid peroxides were decreased. The data suggest that vitamin E supplementation improves immune responsiveness in healthy elderly.

o Vitamin A and Vitamin E Intakes in Elderly

Many comprehensive studies of the elderly have indicated that vitamin A deficiency is uncommon. Blood values for vitamin A have been shown to be similar in persons of various ages. Other studies have indicated that vitamin A storage levels in the liver are normal throughout the aging process. Despite these reports, other studies have shown that the elderly were consuming less than two-thirds of the RDA for vitamin A. This observation implies that the RDA may be too high for selected elderly persons. Liver overload with vitamin A can result in liver damage. The

elderly often supplement with megadoses of vitamin E that have been shown to increase vitamin A uptake and storage. Accordingly, a study was conducted to determine the relationships of supplemental and total vitamin A and vitamin E intake on vitamin A status. The main finding is that supplemental vitamin A is associated with greater levels of the ester form of vitamin A in blood and indicate that the elderly may be more sensitive to this form. Five of the elderly subjects with extremely elevated circulating retinyl ester form of vitamin A also had indications of liver disease. Thus, vitamin A supplementation appears to result in more of the ester forms of vitamin A in blood of the elderly, which, in turn, may be associated with liver damage.

6. Nutrient Functions

o Regulation of Ferritin Synthesis by Iron

Iron is essential in the diet, but in excessive amounts can damage the cells of the body. To prevent this, excess iron is stored in cells within a protein ferritin, made up of two types of subunits. In order to ensure enough ferritin molecules when the cell contains excess iron, formation of new ferritin is regulated by the level of free iron in the cells. It is now shown that this response occurs at the level of the cell DNA (transcription) and also at the site of protein formation (translation). The latter mechanism is rapid and ensures a quick build-up of new ferritin molecules, while translational control allows flexibility of the relative amounts of the two different types of subunits making up the ferritin molecules. This latter control point can optimize the ferritin molecule shell to promote efficient iron storage.

o Zinc Involved in Temperature Regulation

Information is limited about the physiological effects of zinc deficiency. Some recent observations suggest that zinc deficiency might affect energy metabolism. The effects of zinc deficiency was studied in animals on temperature regulation in the cold. The zinc-deficient animals were unable to increase or to maintain their internal body temperature in contrast to animals receiving adequate zinc or restricted energy intake. Thyroid hormones (thyroxine and triiodothyronine) in the blood, the major mechanism for increasing body heat production, were lower in the zinc-deficient animals. Thus, zinc-deficiency appears to adversely affect thyroid hormone metabolism and thereby reduce the capacity to produce heat and maintain body temperature.

o Nutritional Modulation of Human Immune Status

A decrease in the intake of total fat calories and an increase in the proportion of dietary polyunsaturated fatty acids (PUFA) has been advocated by some groups to lower the risk of cardiovascular diseases. An increase in dietary PUFA has been reported to suppress immune status (ability to fight infections) in animal models but the effects of such changes on the immune status of humans is not known. Accordingly, the effects of nutritionally balanced low fat diets containing moderately high (12.9% calories) and low

(3.5% calories) levels of PUFA on the immune status of healthy men were compared. In this study, the levels of PUFA used did not affect any of the indices of immune status tested. It is of interest to note that the immune status of these men improved during the experimental period. Possible reasons for this improvement might include reduction in calories from fat or balanced and adequate supply of other nutrients.

o Effect of Dietary Calorie Restriction

As we age, our immune system does not function as well as when we are young. This decrease in immune function contributes to increased incidence of infectious disease and cancer in the aged. One of the most effective ways to delay onset of immunological changes associated with aging is dietary calorie restriction. The mechanisms of immunostimulatory effect of calorie restriction are not well understood. Calorie restriction has been found to reduce prostaglandin E2 (PGE2) formation, a substance which suppresses cell-mediated immune function. The reduction in PGE2 formation, by calorie restriction, may, therefore, be an underlying mechanism for the immunostimulatory effect of calorie reduction. Although calorie restriction is very effective in delaying age-associated changes in immune response in rodents, it's recommendation to elderly persons is not practical. However, by understanding the mechanisms of effectiveness of calorie restriction, other more practical dietary interventions can be designed. The importance of these findings is that PGE2 level can be changed by dietary factors such as fat and vitamin E.

o Short-Term Vitamin E Deficiency May Protect Against Malaria

Malaria continues to be a serious global threat to human health with about 500 million estimated clinical cases appearing annually, 2.3 million of which are fatal. Particularly worrisome is the widespread emergence of drug-resistant strains of the parasite Plasmodium falciparum in many areas of the world. Attempts to develop a vaccine against this organism have met with only limited success. A novel method has been developed for controlling the disease by nutritional manipulation of the host. This method exploits the metabolic weaknesses of the parasite and subjects the parasite to a nutritional stress which limits its ability to reproduce. Feeding a fish body oil (menhaden oil) in a vitamin E-deficient diet to mice afforded significant protection against a strain of the parasite that is resistant to the most commonly used antimalarial drug, chloroquine. This appears to be due to the critical need for vitamin E by the parasite, as the effect of fish oil was not observed when ample vitamin E was also added to the diet. Should this approach be feasible in humans, it could revolutionize the way that malaria is treated and/or prevented around the world and save thousands of lives annually.

o Copper-Deficient Diets Influence Subsequent Brain Function

Electrical activity of the brain was recorded in 36 unanesthetized male rats fed a Cu-deficient diet for 100 days following weaning. The diet was supplemented with drinking water containing either nothing or adequate copper. Cu deficiency was verified by analysis of plasma, brain liver, and

hair. Differences in brain wave activity between Cu depleted and Cu adequate rats indicate that dietary Cu deficiency influences function in the mature brain in very specific ways. These findings indicate that dietary Cu deficiency imposed following weaning influences function in the mature brain, and that these effects on brain electrophysiology are frequency and location specific. These effects of Cu depletion differed from those found in response to nonspecific malnutrition as reported by others.

o Adequate Copper Essential for Development of Immune System

Dietary deficiency of copper, an essential micronutrient, impairs the immune system of humans and other animals. The biochemical mechanisms responsible for suppressed immune system in copper deficiency are unknown. Accordingly, studies were performed to examine the effects of dietary copper deficiency on the characteristics of several major classes of immune cells in the blood of young rats. Blood was chosen for analysis because it may be readily obtained from humans and may be useful for monitoring their copper status. Relative percentages of T-lymphocytes, were significantly reduced, while the percentage of B cells and monocytes were elevated by Cu deficiency. In vitro responsiveness to optimal concentrations of antigens was decreased 2-3 fold by Cu deficiency. The results demonstrate that dietary Cu deficiency alters the relative numbers and function of T-cells in peripheral blood of young rats and suggest that these changes may enhance susceptibility to infection.

o Copper Deficiency Alters Response of Platelets

Daily diets in the United States often contain less copper than required to compensate for daily losses through excretion. It is important, therefore, to assess the possible health consequences of low dietary copper. Knowledge needed to make such an assessment can be obtained by delineating which physiological components are altered when dietary copper is restricted. Investigations show that copper deficiency in rats affects the interaction between cytoskeletal proteins and alters the physiological response of platelets to thrombin, a naturally occurring platelet activator. Specifically, copper deficiency enhanced myosin association with the cytoskeleton of thrombin-activated platelets. Furthermore, the rise in intracellular free calcium that normally occurs following thrombin activation was decreased 35 percent by copper deficiency. These findings indicate that functional properties of platelets, including secretions that depend on the interplay between cytoskeletal components following activation, are likely to be altered by copper deficiency. Since platelets play a major role in homeostasis and thrombosis, and are involved in inflammation, immune reactions and interactions with tumor cells, changes in platelet function associated with altered interaction between cytoskeletal components may contribute to the health effects of low copper status.

o Effects of Dietary Arsenic Deprivation on Plasma Carnitine

Previous research has shown that the ultratrace element, arsenic, may be essential for animals. Although the physiological function of arsenic is unknown, it is thought to have a role in how the animal utilizes the amino

acid methionine. Because methionine is important for the formation of carnitine, a study was undertaken with rats to ascertain the effect of arsenic deprivation on carnitine levels in blood. Carnitine is a compound which is necessary for proper fatty acid transport and metabolism. The findings indicated that arsenic deprivation tended to decrease plasma carnitine levels. The results confirmed that arsenic has a role in methionine metabolism.

C. Role of Nutrition in Health Promotion and Prevention of Diet-Related Disorders

1. Energy Metabolism and Weight Maintenance

o Energy Expenditure Determined in Men

Several methods are available for determining the calories used in a day by humans. Some of these methods may be better suited for measuring metabolic rate in people in their normal environment. Other methods are better suited for measuring metabolic rate in controlled conditions during controlled experiments. A study was done to compare the metabolic rates of adult men in a controlled environment to their normal metabolic rate. Several measurements of the metabolic rate of men were made in our metabolic chamber and during their daily routines. These measurements indicate that people restricted to a single room use approximately 17% less calories than when engaged in their normal activities. The experiment also determined the accuracy of the methods used to measure the metabolic rates of the men. The methods of measuring metabolic rates developed and refined by this lab are useful tools in the study of the nutritional requirements of people. Metabolic rates vary widely between individuals depending on genetics, sex, occupation, eating habits and lifestyle. The correct determination of metabolic rates will help us understand the causes of obesity and malnutrition.

o Energy Restriction and Diet Composition on Energy Expenditure in Men

An experiment was conducted to estimate the effect of reducing food intake by 50 percent on the amount of calories burned by an individual. When food intake was reduced, energy expenditure decreased. As the individuals lost weight, energy expenditure declined further, proportional to the weight loss. After 4 weeks of "dieting," subjects were fed at a level equal to their preweight loss intake. Energy expenditure returned to the preweight loss level. The conclusion was that the decrease in energy expenditure associated with "dieting" can be accounted for by (1) the lowered energy requirements for processing the reduced level of food intake, and (2) the lower energy required to maintain a smaller individual. In addition, subjects were fed a high-fat or a low-fat diet for the length of the study. This was used to determine the influence of fat in the diet on the amount of fat lost during the low food intake period. Fat content in the diet had no effect on the amount of fat lost during the low food intake period. This work benefits both the scientific community and the public by providing information on the effects of "dieting" on energy requirements of individuals and the effect of fat levels in the diet on body composition.

o Energy Intake and Body Composition Responses to Exercise in Overweight Women

Approximately one-third of American women are estimated to be overweight or obese. Several health risks are associated with obesity such as premature heart disease, high blood pressure, diabetes, and some forms of cancer. Overweight women will be at greater risk for these diseases once they have

reached menopause. Thus, it's important to establish effective treatment programs for controlling weight prior to menopause. A study was conducted of 12 overweight women to determine the effect of daily exercise on food choices and nutrient intake. Body weight, lean body mass, and body fat were measured throughout the study to determine if exercise affected body composition. Exercise did not affect, consistently, food choices or intake of calories, carbohydrate, protein or fat. Exercise did increase lean body mass. On the average, after 18 days of daily aerobic exercise, lean body mass increased approximately 1 kg (2.2 lbs.) with exercise of moderate duration and an additional 1 kg with exercise of long duration. Exercise did not affect body fat consistently. The lack of an exercise effect on food intake indicates that individual response to exercise is not predictable. Thus, a weight control program of exercise alone cannot guarantee reduced food and caloric intake or loss of weight or body fat.

o Exercise and Diet Restriction in Women

Recent research at WHNRC has focused on diet and exercise interactions that affect energy expenditure and weight reduction in moderately overweight women. A program of aerobic exercise and mild calorie restriction, yielding a 50 percent energy deficit, led to weight loss of 1 kg/week. Calorie restriction alone, also yielding a 50 percent energy deficit, produced a similar rate of weight loss, but a greater proportion of the weight loss was lean body mass (LBM) with this intervention. Inclusion of aerobic exercise in the weight reduction program increased physical fitness and reduced the loss of LBM. A subsequent study examined the metabolic effects of exercise training. Ten overweight women resided in a metabolic unit. Half of the women were assigned to a 12-week intervention of diet and exercise, which included a 50 percent reduction in energy intake and a daily program of aerobic exercise. The others were assigned to the same daily exercise but consumed a diet of adequate energy content. Diet had no effect on aerobic capacity, although a 13-15 percent improvement had occurred by 6 weeks in both groups. Energy expenditure at submaximum workloads also was not affected by diet but was affected by length of intervention. Tests of strength and power were not affected by diet or by aerobic training. These results suggest that, in healthy women, a moderate restriction of energy intake does not adversely affect physical performance.

2. Dietary Lipids

o Fish Oil Fatty Acids Suppress Inflammatory Agents

The purpose of this study was to characterize more carefully the effects of fish oils that are rich in omega-3 fatty acids on immune function, specifically on two agents which are known to be involved in the inflammatory process. These two substances are known as interleukin-1 and tumor necrosis factor. Both substances are involved in the ability of the body of fight infection. These substances are made by white blood cells in response to injury or infection. In this study, six volunteers added 18 grams (capsules) of fish oil to their diet each day for a 6-week period. Fish oil use was

associated with a marked decrease in both interleukin-1 and tumor necrosis factor production by white cells. Therefore, the anti-inflammatory effects of fish oils appear to be mediated by a decreased production of these substances by white cells.

- o Measurement of Metabolic Interconversion of Deuterium Labeled Fatty Acids

There is a growing concern about fats in the human diet. As part of a study to determine the metabolic fate of various fats in humans, an analytical method has been developed to completely analyze the fatty acids in human blood resulting from the digestion and metabolism of dietary fats. Deuterium, a stable isotope of hydrogen, was put into fats that were fed to human subjects, so that the individual fatty acids could be followed through the metabolic process. The analytical method was developed to measure small amounts of deuterium-labeled fatty acids along with the other fatty acids normally found in blood. The technique uses capillary gas chromatography, multiple-ion-monitoring mass spectrometry, and isobutane chemical ionization. The method makes extensive use of standards and computer processing for accuracy and high productivity. The method has advantages over other methods in that, the labeled fatty acids are determined as intact molecules and reported as % labeled fatty acids, rather than as % deuterium enrichment. The advantage of this approach is that the labeled fatty acids can be more easily identified and correlated with the naturally-occurring fatty acids. The analysis of intact molecules allows mixtures containing more than one deuterium labeled fatty acids to be fed, which would not be possible if the compound were combusted and analyzed by isotope ratio mass spectrometry. Extensive use of computers makes it possible to identify all labeled fatty acids from C14 to C24, which are formed by saturation, desaturation, elongation, or shortening of the fed labeled fatty acids.

- o Dietary Fat and Hormonal Influences on Lipoproteins in Premenopausal Women

Reduction of total dietary fat and cholesterol and replacement of some saturated fatty acids with polyunsaturated fatty acids are commonly recommended to prevent heart disease and cancer. Major reductions in dietary fat are being considered for breast cancer prevention in women at risk. Questions arise then about the effects of such diet changes and menstrual cycle variations in hormone levels in women on plasma lipoprotein properties. Therefore, the effects of lowering dietary fat were studied on the composition and fluidity of plasma lipoproteins in women. Thirty-one women consumed either a high-fat diet, containing 40 percent fat calories, or a low-fat diet, containing 20 percent fat calories. The ratio of polyunsaturated fatty acids to saturated fatty acids (P/S ratio) was 0.3 in the high-fat diet and 1.0 for the low-fat diet. Lipoproteins measured from blood samples taken during the follicular and luteal phases of their menstrual cycle revealed effects due to fat level and types. The low-density lipoprotein was significantly more fluid after eating the low-fat, P/S 1.0 diet than after eating the high fat, P/S 0.3 diet. Generally, the low density lipoprotein was more fluid in the follicular

phase of the cycles, indicating hormonal influences on fluidity. Results with the high-density lipoprotein were similar but less pronounced. Hence, lipoprotein fatty acid composition was affected by diet and hormonal state. Generally, the amount of lineolate was reduced and amount of oleate increased in the lipoproteins when the lower fat diet was eaten. The fluidity of the lipoproteins was observed to be more dependent on the cholesterol content of the lipoprotein than its fatty acid composition.

o Dietary Fatty Acids Affect Blood Pressure in Adult Men

Coronary artery disease (CAD) causes more than half a million yearly deaths in the U.S. at a cost of over $60 billion a year. The dietary link between diet and CAD is most evident in the fat component. The decreased incidence of the disease observed during the last 20 years has been in part attributed to changes in type and quantity of fat Americans consume. A study was conducted to elucidate the biochemical mechanism and possibly reveal the cause-effect relationship. A diet containing a relatively high quantity of polyunsaturated fatty acids of the omega-6 type fed to 24 free-living male subjects was found to cause increased production of a biologically potent substance called prostaglandin (PG)E2. (PG)E2 influences myocardial and coronary circulation and contributes to regulation of blood pressure. These results suggest that some of the physiologic effects of certain diets are due to metabolic alteration of a group of hormone-like compounds called eicosanoids of which (PG)E2 is a member.

o Dietary Polyunsaturated Fatty Acids Reduce Blood Coagulation

Large intakes of saturated fatty acids are believed to increase the risk for heart attacks. This is caused by changes in blood platelets which make them clump more easily. Substituting polyunsaturated fatty acids for some saturated fatty acids in the diet should make platelet aggregation more difficult, and heart attacks more rare, by increasing the amount of aggregating agent needed to clump the platelets. In a human study, minimum amounts of aggregating agents (ADP and collagen) needed to aggregate platelets were measured. Two groups of healthy men were fed diets which differed only in their amounts of polyunsaturated and monounsaturated fatty acids. Total fat and saturated fatty acid levels did not differ between diets. It was found that the aggregation thresholds for ADP and collagen increased on the high polyunsaturated fatty diet, meaning that increasing the relative amount of polyunsaturated fatty acids in the diet may decrease the risk for heart attacks. In another study, the effect of fish oil fatty acids on blood platelet function was studied in rats by monitoring the responses of the cells in various types of agents that promote clot formation. Platelets from animals fed fish oil demonstrated decreased responsiveness to agents that stimulate signals by binding to receptors on the cell membrane. However, when an agent (fluoride) that bypasses the cellular membrane and stimulates platelets directly was used, no differences were observed in responses between platelets from the two groups. These results suggest that dietary marine oils act to dampen receptor-mediated signals by interfering with the flow of information from the membrane surface to the interior of the cell.

o Fatty Acid Profiles Change in Women on Low-Fat Diets

A controlled feeding study was conducted to see if fatty acid profiles of serum could be used to distinguish between people eating low-fat or high-fat diets. Fatty acid profiles were measured from two sources, serum cholesterol esters and serum phospholipids, in 49 postmenopausal women. After baseline measurements with subject on their usual diets, subjects were assigned for 6 weeks to one of two low-fat (20% of energy) diets differing only in the ratio of polyunsaturated to saturated fat (P:S ratio). After a 4-week rest period, the diets were switched in the two groups. Changing from usual diets to low-fat diets caused more change in fatty acids than did the change in P:S ratio. When subjects ate either of the low-fat diets rather than their usual, high-fat diets, significant changes were noted in 7 of 10 cholesterol-ester fatty acids and 12 of 15 phospholipid fatty acids. Use of statistical modeling allowed correct classification of diets as usual or low-fat with a high degree of accuracy. These fatty acid profiles can serve as biochemical markers that may prove useful to researchers, not only for monitoring adherence of subjects to low-fat diets, but also for characterizing fat intake in epidemiologic studies of the relationship of dietary fat to disease.

3. Dietary Fiber and Carbohydrates

o Influence of Dietary Fiber on Cholesterol

There is a need to identify dietary components in foods which are effective in lowering plasma cholesterol. The influence of combinations of oat and wheat bran on cholesterol and vitamins A and E were evaluated in cholesterol-fed rats. When diets containing a mixture of oat and wheat fiber (2:1) were fed, significant reductions in liver cholesterol levels were observed. The availability of vitamins A and E was not affected by dietary fiber in cholesterol-fed rats. Oat fiber in combination with wheat fiber (2:1) provides sufficient oat fiber to effectively lower cholesterol. Oat fiber alone resulted in the greatest cholesterol reduction.

o Copper Deficiency and Sucrose in Young Pigs

Previous studies with laboratory rats have shown that simple sugars (sucrose/fructose) increase the amount of dietary copper required for normal growth and health. Because typical Western diets contain presumably rather marginal levels of copper, the increasing amounts of sucrose and high fructose corn syrup consumed instead of starches, raises the concern that the copper-carbohydrate interaction also may affect human health. Since the cardiovascular and digestive systems and nutrient requirements of the pig are very similar to humans, this animal was used as a model to compare the effects of feeding sucrose or cornstarch on the consequences of copper deficiency. Young pigs were fed diets containing sucrose or cornstarch (as 60% of total dietary calories) and either adequate or deficient amounts of copper for 10 weeks. Copper deficiency resulted in stunted growth, anemia, enlarged hearts, increased cholesterol and decreased tissue levels of copper regardless of the carbohydrate (sucrose or cornstarch) fed. These data suggest that acute health-related consequences observed in male rats fed diets low in copper and high in sucrose or fructose do not constitute important risk factors for human health.

- o Abnormal Carbohydrate Metabolism in Copper-Deficient Fructose-Fed Male Rats

Diets consumed by people living in industrialized societies contain relatively high levels of simple sugars but are marginal in copper. A deleterious interaction between dietary carbohydrate and copper has been shown to occur in rats. The severity of copper deficiency in rats is determined by the type of dietary carbohydrate consumed and by the sex of the animal. The copper deficiency of the male rat eating fructose is characterized by a fatty liver, hypercholesterolemia, enhanced lipid peroxidation, pancreatic atrophy, anemia, and mortality. The reasons for the morbidity and mortality of copper deficiency could not be due simply to low tissue copper levels, since copper deficient intact and ovariectomized female rats have been fed the copper-deficient diets longer than males and their hepatic copper levels are lower than males, yet they exhibited none of the undesirable effects of copper deficiency, except for anemia. The hypothesis was tested that certain metabolites of fructose accumulate in tissues of males, but not female rats eating fructose, and interact with copper to produce the deleterious effects observed in copper deficiency in males. Indeed, regardless of copper status, glucose, fructose, sorbitol, and glyceraldehyde accumulated in tissues of male rats consuming fructose. Sorbitol accumulation was greatest in the copper-deficient male rats consuming the fructose diet. Female rats eating fructose and male rats eating starch do not exhibit abnormal carbohydrate metabolism, and are protected against the deleterious effects of copper deficiency.

- o Chromium Excretion and Insulinogenic Properties of Sugars

Insufficient dietary chromium is associated with impaired glucose and insulin metabolism. This work establishes that sugars and other carbohydrate foods that increase insulin levels lead to increased chromium losses. As insulin levels increase and overall function declines, the ability to mobilize chromium also declines. These decreases in insulin activity and chromium stores may lead to maturity-onset diabetes.

4. Reduction of Cardiovascular Risk Factors

- o Antioxidants Inhibit Cardiovascular Effects of Copper Deficiency

Superoxide and other highly reactive oxidative free radicals are continually produced in the process of metabolizing energy substrates. A variety of enzymes are present in the cells of the body to destroy these so-called free radicals, and thus prevent them from oxidizing tissues. Some of these enzymes are dependent on copper for their activity and are, therefore, inactivated in copper deficiency. Because of this, it is postulated that some of the deleterious effects of copper deficiency may be caused by free radical damage. We have investigated this free-radical hypothesis of damage by feeding rats substances with known antioxidant activity, specifically dimethyl sulfoxide (DMSO) and t-butylhydroquinone (TBHQ), to determine whether some of the cardiovascular effects of copper deficiency could be inhibited. We found

that DMSO, a hydroxyl radical scavenger, and TBHQ, a food additive which prevents oxidation of lipids, both inhibited the cardiac enlargement, cardiac edema formation (an index of inflammation) and anemia caused by copper deficiency. This finding supports the view that cardiovascular defects of copper deficiency may be caused by damage from oxidative free radicals and suggests that the use of antioxidants as food preservatives may be of value in protecting the consumer against the effects of a low copper diet.

o Premature Atherosclerosis Due to Deletion of Gene Complex

It has been known for some time that low levels of plasma high density lipoprotein (HDL) are associated with an increased risk of heart disease. HDL has been shown to be important in removing cholesterol from various tissues including the artery wall. A study was done involving a genetic defect in a family in which HDL was totally missing in one member and HDL levels were half of normal in ten relatives. The defect was found to be due to a deletion of three genes right next to each other on the long arm of chromosome 11. These three genes code for three proteins that are carried in the blood and which are important for binding cholesterol. All three proteins are involved in HDL metabolism. These individuals with restriction fragment length polymorphisms also exhibited plasma HDL deficiency and premature artery disease. These studies point to the important role of the apoA-I protein in the formation of HDL as an independent risk factor for premature atherosclerosis.

5. Bone Density and Osteoporosis

o Vitamin A Excess Not Harmful on Bone Remodeling in Aged Rats

Acute vitamin A toxicity causes rapid bone loss in rats and in humans. A number of the elderly have more vitamin A and less calcium in their diets than is recommended. This study was conducted to determine whether chronic modest increases in vitamin A intake either alone or in combination with low-calcium intake contribute to bone loss. Aged rats were fed diets with vitamin A content of the daily requirement 2-fold, and 5-fold the daily requirement, along with the recommended intake or one-third of the recommended intake of calcium for 14 months. Tissue analysis of the lower spine as well as measurement of calcium intake and excretion were performed. Vitamin A intake had no effect on the calcium loss of the extremities. In contrast, a 2-fold excess of vitamin A caused a modest but significant increase in the amount of bone present in the lower spine. A 5-fold excess, however, had no net effect on the spine when compared with control. Low calcium intake retarded bone growth, but had no other effect on the spine. Thus, a mild excess of vitamin A does not contribute to bone loss in elderly rats and may, in fact, be beneficial to the spine.

o Collagen in Bones Affected by Dietary Protein

Nutrition surveys have shown that dietary protein intake in the United States exceeds the recommended dietary allowance (RDA) for all age groups, including growing children. Recent evidence indicates that tissue structure may be affected by excessive protein through alteration of the metabolism of the tissue forming protein, collagen. The crosslinking of collagen in growing animals has been studied to assess the effects of minimal and excessive

dietary protein levels on the structural integrity of bones. Compared to the control group, both the minimal and excessive protein effected a difference in the crosslinking between the femurs and humeri. The primary difference was seen in the relative amounts of the stable crosslink which has been shown to be related to the mineralization process in developing bones. The implications of this study are that the amount of dietary protein exerts an influence on the structure of bone during growth which may have an effect on remodeling of adult bone and the predisposition of bone disorders during nutritional stress.

o Effect of Age on Calcium Retention in Bone

Osteoporosis, or thinning of the bones, is a serious health problem in the U.S. which occurs especially in older women and may be affected by the amount of calcium eaten. In an effort to determine whether increasing the calcium in the diet would result in "stronger" bones, young and aged female rats were used. The young rats fed high calcium diets formed "stronger" bones compared to no effect for the old rats also fed the higher amount of calcium. These results suggest that to assure strong bones, young people should eat foods that will provide adequate calcium build-up in their bones. In contrast, in older females the use of dietary calcium supplement may not prevent bone loss.

o Effect of Menopause and Aging on Serum Calcium and Protein

Varying effects of menopause and aging on serum total and ionized calcium concentrations have been reported. This has contributed to the difficulty in understanding the factors which regulate calcium and bone health in postmenopausal women. Accordingly, serum concentrations of total and ionized calcium, albumin, and globulins and serum pH were measured in 402 normal women, aged 18 to 72 years, who were being enrolled into field trials. Serum total calcium was found to increase after menopause and decrease with aging. In serum, part of the calcium is ionized and part is bound to albumin and globulins, with more binding at high pH. The increase at menopause was associated with increases in serum globulins and serum pH. The age-related decline in total calcium was associated with an age-related decline in serum albumin concentration. Serum ionized calcium concentration did not vary either with age or menopause. This study demonstrates the value of measuring ionized calcium in clinical studies of calcium and bone metabolism.

o Boron Affects Maturation of Cartilage

Previous research has shown that dietary boron affects the rate of cartilage mineralization at the ends of long bones in vitamin D-deficient chicks. To determine whether boron is important for building and maintaining healthy bones, an experiment was designed to determine the effects of dietary boron deprivation on cartilage structure in vitamin D-deficient chicks. In chicks fed boron to 28 days of age, the region of cartilage which is maturing and preparing for calcification was affected. In that region, the number and total perimeter of cartilage cells increased, as the amount of boron in the diet was increased. Thus, vitamin D-deficient chicks fed diets containing boron exhibited larger cartilage cells in the area undergoing maturation. The findings suggest that maturation of the cartilage in the vitamin D-deficient chick is sensitive to dietary boron.

o Boron Depletion Causes Bone Mineral Loss in Humans

Osteoporosis is a disorder of older people which is characterized by the loss of bone calcium and increased chances of bone fractures. Osteoporosis affects about 15 to 20 million persons in the United States. About 1.3 million fractures caused by osteoporosis occur annually in people aged 45 years and older. A recent study has confirmed that the dietary lack of the mineral element, boron, contributed to the urinary loss of bone minerals and perhaps to the incidence of osteoporosis. Thus, a study was performed on 15 postmenopausal women and older men with the objective of determining if the lack of boron in the diet may cause changes indicating suboptimal calcium metabolism and bone loss. The blood levels of three hormones involved in calcium metabolism, 25-hydroxy vitamin D, calcitonin and osteocalcin, were changed by boron deprivation in a way similar to that observed in women who have postmenopausal osteoporosis. Boron apparently is needed for optimal calcium metabolism, and thus, is needed to prevent the excessive bone loss which often occurs in postmenopausal women and older men. Eating diets rich in fruits, vegetables, legumes, and nuts, which contain high amounts of boron, may help prevent osteoporosis.

6. Reduction of Risk Factors for Cancer

o Human Selenite Metabolism--A Kinetic Model

Selenium is being considered as a possible protective agent against certain types of cancer. However, little is known about those factors that control its distribution in the body or its route and rate of excretion. Therefore, sodium selenite was given orally to six healthy adults in the form of a stable, non-radioactive tracer and this "tagged selenium" was measured in various tissue fluids and excreta over a 4-week period. The model describes absorption distributed along the GI tract, four kinetically distinct plasma components, a subsystem consisting of the liver and pancreas, and a slowly-turning-over tissue pool. Approximately 84% of the administered dose was absorbed and after 12 days about 65% remained in the body. The model predicts that, after 90 days, about 35% would be retained, primarily in the tissues. Separating Se metabolism into several distinct kinetic components is a first step in identifying the efficacious, nutritious, and toxic forms of the element.

o Plasma Carotenoids in Response to a Meal

Scientific evidence is accumulating that the type of food eaten may play a part in whether a person develops cancer. Epidemiological studies indicate that people who eat high amounts of fruits and vegetables have less of a chance of developing cancer. Therefore, there is much interest in whether the cancer preventing factors from vegetables are the "carotenes" which give the vegetables color, e.g., carrots. The results of this study show that the blood levels of these carotenes do not change when a meal is eaten. The effect of a standardized test meal was measured after an overnight fast on the concentrations of plasma carotenoids, retinol and tocopherol in eight healthy adults. A 790 kilocalorie test meal did not alter the plasma concentrations of 7 carotenoid fractions, retinol or tocopherol. A blood sample drawn up to

4 hours after breakfast appears to have no significant effect on these indices. Therefore, people do not need to fast but can eat normal meals, before a test is made to determine the level of carotenoids in their blood. This will make it easier to carry out field studies and epidemiological surveys which may necessitate obtaining a non-fasted blood sample for nutritional assessments.

o Fecal Mutagenicity, Risk Factor for Colorectal Cancer

Cancer of the colon accounts for the second most common cause of cancer deaths in this country. To a large extent, diet and lifestyle have been implicated as contributory to this high mortality. In a search for indicators of risk, the ability of stool extracts to cause mutational changes in certain test bacteria has been measured. Fecal mutagenicity was measured in 68 patients with colorectal cancer and 114 controls. Samples also were tested for fecapentaenes by high performance liquid chromatography, to permit the separation of fecapentaene and non-fecapentaene mutagenicity. When samples containing high concentrations of fecapentaenes were excluded, the remaining TA98 mutagenicity was associated with a four-fold excess risk of colorectal cancer that achieved marginal statistical significance. It appears, therefore, that this test system has predictive value in risk assessment for colon cancer.

o Caloric Restriction and Colonic Cellular Growth

A number of experimental animal studies have shown that caloric restriction offers protection against cancer development; however, the mechanism whereby this is achieved is not known. A study was done to investigate the effects of calorie restriction on the cellular growth of the colon in rats. Rats were calorie restricted either during the nursing period (3 weeks duration), for the immediate 3-week period after weaning, or during both time periods. Rats restricted only during the nursing period caught up during the 3-week post-weaning period and had normal colons. Rats that were calorie restricted during the 3-week post weaning period or for both time periods had the smallest colons and reduced levels of DNA. Cell turnover was not changed in any group of rats. These results suggest that calorie restriction after weaning may decrease colon cancer by decreasing the total number of dividing cells in the colon.

D. Food Composition and Nutrient Bioavailability

1. Improved Methods

o Simplified Method Devised for Determination of Dietary Fiber

An enzymatic-gravimetric method officially adopted in 1986 by the Association of Official Analytical Chemists (AOAC) for total dietary fiber was intended to be simple, fast, and reproducible; however, the AOAC method still requires a great deal of the analyst's time and multi-step operations. Therefore, a simplified method has been developed which gives comparable results to the AOAC method, yet cuts costs and is much less labor-intensive. The new method eliminates 3 pH-adjustments and 2 enzyme treatments. Using both the AOAC and Simplified methods, total dietary fiber content of 25 foods was determined. Results obtained with the two methods were comparable. With further modifications, soluble and insoluble fractions of dietary fiber also can be measured.

o New Methods for Analysis of Biological Materials

Graphite furnace atomic absorption spectrometry has been used successfully to do both single element and multielement determinations of biological materials. Conventional wet ashing and dry ashing techniques have been used successfully to prepare samples for analysis. Graphite furnace atomic absorption spectrometry lends itself to the direct analysis of liquid samples as well, providing good results with little or no sample preparation time. Solids prepared as slurries also may be introduced into the furnace. Slurry atomization appears to have potential for finely ground materials. A homogeneous particle distribution of the slurry is ensured by agitating the slurry with a hand-held ultrasonic probe unit. A commercial autosampler can be used to introduce samples into the graphite furnace.

2. Food Composition

o International Cooperation in Development and Exchange of Food Composition Data

The Human Nutrition Information Service (HNIS) and the Agricultural Research Services' Nutrient Composition Laboratory (NCL) are participating in a collaborative research project on dietary fiber analyses with laboratories in the United Kingdom, Canada, and the United States. The laboratories analyzed 50 U.S. foods including blind duplicates by the Association of Official Analytical Chemists (AOAC) procedure and by one or two of three other procedures, including the methods of Englyst (official in the U.K.), Mongeau (official in Canada), and Li (AOAC simplified procedure of NCL). Results are being tabulated and evaluated. Evaluation of this collaborative research will greatly enhance the quality of fiber data in the future. Several scientific contacts have been maintained with researchers in Canada, several European countries, and the People's Republic of China relative to the procedures used for generating food composition data bases.

- National Nutrient Data Bank

HNIS continues to maintain and expand components of the National Nutrient Data Bank (NNDB) as the primary mechanism for collecting, evaluating, storing, and collating nutrient composition data of foods. Products of the NNDB are reference values for over 60 food components in thousands of foods Americans consume, including many foods consumed primarily by specific ethnic groups. They are presented in published tables and reports, provisional tables, and in machine-readable forms for a wide variety of users. The products are widely recognized as authoritative and are used throughout the world. Of special importance are the data bases prepared for use in assessing the nutrient content of diets reported in large-scale dietary intake surveys conducted by HNIS and by the National Center for Health Statistics (NCHS) in DHHS.

The NNDB is expanded continually to include results from new analyses conducted by industry, government, universities, and from extramural analyses funded by HNIS. Data reliability is emphasized by: (1) utilizing plans representing the national distribution of food types, (2) evaluating performance on check sample analyses during the contractor selection process, (3) requiring validated analytical methods and documented quality control procedures during contract performance, and (4) promoting uniformity of procedures by encouraging cooperation among contractors, including participation in annual meetings of principal investigators. Plans for extramural research--priorities and procedures--are made in consultation with ARS Nutrient Composition Laboratory and, as appropriate, other agencies which are major users of nutrient composition data within and outside of USDA and the food industry. Research emphasis is in two areas: food components believed to be important to health promotion and disease prevention, and research to fill knowledge gaps for the data base.

Analyses were conducted to fill data gaps. Two extramural contracts were completed on selenium analyses of nationwide sampling of foods. Research was also completed on the nutrient analysis of trace minerals in 133 foods and determination of the individual sugars in 300 samples. Specialized research is underway on a number of nutrients including fatty acids, amino acids, trans-fatty acids, retinol and carotenoids.

- Composition of Lamb, Veal and Game Products and Cereal Grains and Pasta Published

Revision and publication of "Composition of Foods...Raw, Processed, Prepared," Agricultural Handbook No. 8 (AH-8) by major food sections has been ongoing over the past several years by HNIS. To date, 19 of 22 planned sections have been published. New data on the composition of lamb, veal, and game products and of cereal grains and pasta were compiled, evaluated, and values published as sections AH-8-17 and AH-8-20. Computerized data sets for the new sections were issued and the Nutrient Data Base for Standard Reference was revised accordingly.

o Nutrient Composition of Beef Products Revised

Data from two research studies on marketing and nutrient composition of beef are being evaluated for use in updating the nutrient data in the current AH-8-13 Composition of Food Beef Products. The revision will include nutrient data for many retail cuts in AH-8-13 trimmed to 0 inches and 0.25 inches fat. The current handbook represents beef trimmed to 0.5 inches fat. Change in fat trim of beef is based on the Nationwide Market Basket Survey conducted by Texas A & M University on fat trim of average beef retail cuts in supermarkets in 12 cities across the United States. This study revealed a 27 percent reduction in total fat in beef retail cuts. Changes will also be made in the values for the lipid content of the cooked cuts based on a research project also done by Texas A & M University in which cooking yields and fat retentions were determined on cuts trimmed to 0 inches and 0.25 inches fat trim. Data from these studies, funded largely by industry, are used to update the handbook on beef products, thus allowing nutritionists, dietitians, and public health officials to more accurately estimate nutrient intakes from these foods.

o National Pork Retail Market Basket Study

A National Pork Retail Market Basket study, similar to that conducted last year for beef, is underway. This study involves the sampling of various pork cuts in the retail meat case in supermarkets at several major U.S. cities. This study is being conducted by the University of Wisconsin in cooperation with the pork industry, ARS, and HNIS.

o Nutrient Composition of Eggs Updated

HNIS released updated nutrient composition data for raw whole eggs which show that the cholesterol content of whole eggs is 213 mg per large egg, 22 percent lower than the value published in 1976. The updated nutrient composition for eggs is a result of a collaborative research project with the Egg Nutrition Center and three USDA agencies: the Agricultural Marketing Service, the Agricultural Research Service, and HNIS.

The study was conducted by a private laboratory which was selected on a competitive basis. The laboratory followed sampling, handling, and analytical procedures established by the collaborators. Large eggs were from 122 suppliers in July 1988 and 108 suppliers in February 1989. The sampling was nationwide and the suppliers accounted for over 60 percent of the nation's egg production. Eggs were selected at random from those supplied. The yolks were pooled to provide samples for analysis of fat and fat soluble components, including cholesterol. Other nutrients were analyzed in white, yolk, and whole egg samples.

In addition to a decrease in cholesterol between 1976 and 1989, there was also a small decrease in fat content which was reflected in all three fatty acid classes--saturated, monounsaturated, and polyunsaturated. Values for the seven minerals evaluated all decreased; iron decreased the most. Of the eight vitamins available in measurable quantities, four had higher values and four had lower values. The changes in the nutrient data for eggs are explained on

the basis of improved and carefully controlled analytical methods; other factors that may have had an impact on the changes include poultry feeding and management practices. The new data on eggs are included in the 1989 supplement to Agriculture Handbook No. 8. The data will also be included in future releases of machine-readable data sets and incorporated into results from the 1987-88 Nationwide Food Consumption Survey.

o Periodic Supplements to Handbook 8 Begin

The first periodic supplement to the previously issued sections of AH-8 was published this year. These supplements will be issued annually in order to update previously published data and add data for new items. The supplements will contain loose-leaf pages for inserting into the existing handbook sections.

o USDA-University of Texas Nutrient Data Base System

HNIS is cooperating with the University of Texas School of Public Health in Houston to develop a microcomputer system utilizing the USDA Survey Nutrient Data Base. This system calculates nutrient content of recipes and dietary intakes. Unique features include use of the USDA Nutrient Data Bank recipe calculation procedure, use of USDA's expanded file on nutrient retention factors, a new file on cooking yield factors, and the ability to modify and recalculate the USDA survey recipes. It features an interactive coding process, and allows users to add data for additional foods and nutrients while maintaining the integrity of the USDA data base. The first version of this system will be made available to ARS Human Nutrition Research Centers.

o Special Data Bases for Large-Scale Dietary Intake Surveys

Special data bases are developed, documented and maintained by HNIS for use in assessing the content of food energy and 27 nutrients in diets reported in USDA's system of Nationwide Food Consumption Surveys and DHHS's Health and Nutrition Examination Surveys (NHANES) and others. Data bases involved are USDA's Nutrient Data Base for Individual Food Intake Surveys and USDA's Nutrient Data Base for Household Use Surveys. The systems used to generate both data bases were updated with nutrient values and recipes as required for the 1987-88 Nationwide Food Consumption Survey. These updates included the recent data for eggs as well as other updates into the data base. Updated versions of the USDA Nutrient Data Base for Individual Food Intake Surveys and supporting files were provided to DHHS's National Center for Health Statistics for use with NHANES III, the ARS Human Nutrition Research Center in Grand Forks, North Dakota, and the University of Texas School of Public Health.

o Nutrient Data Bank Bulletin Board

The Nutrient Data Bank Bulletin Board was developed by HNIS as a public service to individuals interested in obtaining information about nutrient data via on-line computer. The board is operated as a public service to provide information about all current HNIS publications and computer files on the nutrient composition of foods, as well as announcements about Nutrient Data Bank Conferences and other relevant topics. The information is presented in

the form of bulletins which can be viewed directly or captured (saved) on a disk for review at the user's convenience. In addition, small nutrient data files are available to download for use on the user's personal computer. The computer is online 24 hours a day, 7 days a week, with a few hours a month set aside for performing maintenance work on the computer and files. To access the bulletin board, an individual needs a computer, a modem, communications software, and a telephone to call the board at 301-436-5078.

o Provisional Tables on Dietary Components

Provisional tables of food components of special interest to professionals are issued for a selected number of frequently consumed foods as reliable data become available. A provisional table on the content of stearic acid, total fat and other fatty acids in selected foods was published. Two other previously issued provisional tables on fatty acids and cholesterol, and omega-3 fatty acids were revised and reissued to professionals.

o Copper Content of Foods Summarized

Copper is an essential nutrient for plants and animals, including humans. In order to assess copper nutriture for humans, practitioners and researchers need accurate and precise copper data for foods. Hence, more than 225 scientific articles containing copper data were collected and rated according to criteria developed for evaluating nutrient data. Mean copper values for each food were calculated from the acceptable data and combined with USDA frequency of consumption data. This resulted in a list of 218 major contributors of dietary copper. The richest sources of copper include legumes, bran cereals, organ meats, shellfish and grains. However, more than half of the values for foods are based on analyses of limited quantity and/or quality, indicating a great need for improvement in food copper data.

o Nutrient Composition of Bison Meat

The nutrient composition of meat from bison was determined and compared with that of beef and other domestic sources of meat. Thirty bison were analyzed for various nutrient parameters which included moisture, protein, fat, cholesterol, energy, minerals and fatty acids. The longissimus muscle was removed, frozen and lyophilized. In addition, nine shoulder roasts and three round steaks also were collected. The relative amounts of these nutrients to the total caloric value makes bison a highly nutrient dense food similar to domesticated meats such as beef, pork, and chicken. The lean tissue was low in fat (less than 2%) and contained only 138 Kcal/100 g of energy on a raw weight basis. Cholesterol values were similar to other meats. Bison loin eye muscle appeared to have higher concentrations of phosphorous, calcium, iron, and magnesium, but lower concentrations of potassium, copper, manganese, and zinc than beef. No differences were observed for sodium. Relative percentages of saturated and unsaturated fatty acids were similar between bison and beef; however, individual fatty acids varied, with bison containing greater amounts of stearic and linolenic acid but less palmitic and myristic acid.

3. Bioavailability

o Zinc Availability From Foods

Data from animal and human studies show that zinc availability from some foods depends on the amount of food consumed. The extent to which the body can use zinc from foods was studied by feeding small amounts of a zinc radioisotope with food and measuring its retention by the body. Zinc from some foods, such as chicken, milk, and peanut butter, was more available to rats when the foods were fed in moderately high, rather than low amounts. Zinc from other foods, such as beef, oysters, navy beans, soybean flour, and whole wheat bread had similar relative availability, whether the foods were fed in moderately high or low amounts. In contrast, zinc from beef was less available when fed to humans in moderately high, rather than low amounts. Thus, relative zinc availability depended on the amount of the food consumed, presumably because the body has different physiological responses to varying amounts of food. Until these responses are better understood, it is unlikely that scientists will be able to predict zinc availability from foods without actual tests in animals or humans.

o Acidity Affects Absorption of Folic Acid

Intestinal absorption of folic acid is most efficient in a mildly acidic environment. To clarify the nature of this relationship, folic acid absorption was studied in rat small intestine by an influx chamber method which permits the evaluation of effects of different acidities on folate uptake into the intestine. The data indicate that the effect of a weak acid on absorption is due to a change in the carrier protein which transports folic acid across the intestinal membranes or due to a direct effect on the folic acid molecule itself. Practically, the significance of these studies relates to the fact that certain drugs influence the acidity of the intestine and, therefore, may affect folic acid absorption. Also, the loss of ability to secrete stomach acid which occurs with advancing age can result in less folate absorption and to an impaired folate status in the elderly.

4. Nutrient Interactions

o Effect of Ascorbic Acid on Iron Absorption in Young Women

Research has shown that vitamin C will improve iron absorption from foods eaten in a single meal. But would vitamin C supplements taken repeatedly for several weeks help someone with low body iron stores? An experiment was designed to answer that question. Eleven premenopausal women ate a low iron diet and gave blood until their body iron stores were depleted. They were then fed a diet containing a moderate amount of iron which was mostly from plant sources (nonheme iron, the form of iron that is absorbed better with vitamin C). For 5 1/2 weeks, they were given either an inactive placebo or 500 mg vitamin C three times daily with meals. Iron absorption was measured by comparing the amount of iron consumed to the amount excreted in the feces. Vitamin C improved iron absorption substantially, from 27% for the placebo group to 38% for the vitamin C group. Vitamin C also improved some, but not

all blood measurements of iron nutrition. This study shows that vitamin C will improve iron absorption and retention in iron-depleted women consuming a diet with predictably poor iron availability, on a regular basis for at least 5 1/2 weeks.

o Zinc Availability from Beef Served with Various Foods

Beef contains high concentrations of zinc. Moreover, beef consumption in the U.S. is fairly high. Thus, beef has been estimated to supply as much as half of the zinc in the U.S. diet. We previously found that zinc absorption from beef eaten alone was greater than when beef was served with a bun, potatoes, and a milkshake. To extend this, a study was done to find out how zinc absorption from beef was affected when beef was served with bread, rice or potatoes; or with milk, orange juice or coffee. Zinc absorption from 7 oz of beef alone was significantly higher (29%) than the average zinc absorption from beef served with bread, rice, or potatoes (20%). In a second study, zinc absorption from beef alone was also significantly higher (35%) than the average zinc absorption from beef served with milk, orange juice, or coffee (29%). However, meals of beef served with other foods are still good sources of zinc. Each of the meals in this study provided 1.1 to 2.2 mg of absorbed zinc. This is 50 to 100% of the estimated daily zinc requirement for adults.

o Mineral Balance on High-Fiber Diet

Diets containing foods high in dietary fiber and low in fat have been associated with a reduced risk of bowel cancer. Increased dietary fiber intake has been reported to decrease bowel transit time, and increase stool bulk, both of which would decrease contact time of potential carcinogens with the intestine. However, high fiber intakes also have been reported to impair mineral absorption and to cause negative balance of some minerals. To investigate the effect of diets containing high levels of dietary fiber from legumes, cereals, fruits and vegetables on mineral balance, male subjects were fed a high-fiber, low-fat diet or a low-fiber, high-fat diet for 10 weeks each in a crossover design. The two diets contained an average of 31 and 12 grams of neutral detergent fiber, and 19 percent and 40 percent of their calories from fat, respectively. The diet high in fibrous foods resulted in an increase in both intake and excretion of several minerals, including calcium, magnesium, manganese, iron, zinc, and copper, with higher total retention of calcium, magnesium, zinc, and copper. Total retention of manganese and iron was not significantly different between the two diets. The results indicated that a diet high in fiber from foods and mineral levels above the recommended dietary allowances can lead to positive mineral balances.

o Pancreatic Function Affected by High-Fructose, Low-Copper Diet

The dietary consumption of copper by people living in the U.S. is believed to be only marginal. Fructose is a natural sugar present in the diet in small quantities, but because of its sweetness, it has become a popular replacement

for sucrose. Researchers from this laboratory have reported that feeding male rats a diet low in copper with fructose rather than starch produces more severe copper deficiency signs and can lead to death. The pancreas produces the enzymes necessary to digest the foods consumed during a meal. Since the pancreas is aversely affected by copper deficiency, we have examined the effect of feeding rats a low copper diet in which fructose has been substituted for starch. Copper deficiency with fructose resulted in severe loss of pancreatic weight and enzyme activities while glucose, fructose, and sorbitol levels were greatly elevated.

o Ascorbic Acid Improves Selenium Metabolism in Young Adults

The effect of changes in dietary ascorbic acid, at extremes of intake, on metabolism of selenite was investigated in young adult male subjects. Subjects were placed on 3-day menu cycle consisting of natural foods known to provide low levels of ascorbic acid. One group received a single dose of the stable isotope label ^{74}Se-selenite after 30 days of consuming the low ascorbic acid (20 mg/day) diet. A second group received daily supplements of ascorbic acid for 10 days followed by administration of ascorbic acid containing the stable isotope label. Gastrointestinal absorption of labeled selenium was somewhat lower (76%) in the ascorbic acid-low group compared with the supplemented group. Retention (14-day) of the absorbed dose also was reduced markedly in the ascorbic acid-low group. The selenite-exchangeable metabolic pool was markedly smaller in the low vs ascorbic acid adequate group. While normal indices of selenium metabolism did not indicate an effect of ascorbic acid status on metabolism of selenium, marked differences were detected using the stable isotope tracer approach. These included decreased absorption and reduced retention of dietary selenium as well as a marked reduction in the selenium-exchangeable metabolic pool when diets containing low levels of ascorbic acid were fed. Marginal state of ascorbic acid may, therefore, lead to disturbances in the normal metabolism of selenium with potential depletion of body selenium stores.

E. Food and Nutrition Monitoring Research

Food consumption by Americans is monitored and their diets are assessed for nutrient content as part of the National Nutrition Monitoring System (NNMS). The five major NNMS categories are health and nutrition status measurements, food consumption measurements, food composition measurements, dietary knowledge and attitude assessment, and food supply determination. USDA has a long history and a prominent role in three: food composition measurement, food supply determinants, and food consumption measurements. With the launching of the follow-up Diet-Health Knowledge Survey with respondents from the 1989 Continuing Survey of Food Intakes by Individuals, USDA has established a prominent role in the area of dietary knowledge and attitude assessment. Progress has been made toward the goals and plans for the NNMS as outlined in the Joint Operation Plan for the National Nutrition Monitoring System from 1987 to 1996 and provided to Congress.

1. U.S. Food Supplies

o Food Disappearance Data

The Economic Research Service (ERS) annually calculates the amount of food available for human consumption in the United States. The food supply data series is a long, continuous series, published first in 1941 and extended back to 1909 for most commodities. It is the only data set available for determining long-term trends in supply and consumption by major food groups. It covers the complete spectrum of primary foodstuffs. Hence, it can be used to measure interrelationships between foods and for measuring total food supply and apparent use. It is particularly useful for estimating complete demand systems that measure price and income elasticities of demand in a consistent way. HNIS uses the ERS data set to estimate nutrients available for human consumption per capita per day. The nutrient content of the U.S. food supply series also dates from 1909. Food supply determinations are one of five components of the National Nutrition Monitoring System.

Total food supply in the United States, and most other countries, is based on records of commodity flows from production to end uses. This involves the development of supply-utilization tables for each major commodity from which human foods are produced. Total available supply is the sum of production, beginning inventories, and imports. These three components are either directly measurable or estimated by government agencies using sampling and statistical methods. Often, production is measured at the farm level; however, for some products primary production is measured at the first level of processing. For most commodity categories, measurable uses are exports, industrial uses, farm inputs (e.g., seed), and end-of-the-year inventories. Normally human food use is not directly measured or statistically estimated. The availability of food for human consumption is, therefore, a "residual" component after subtracting other uses from the available total supply. It represents disappearance of food into the marketing system. Hence, it is often referred to as "food disappearance." Per capita food consumption is calculated by dividing total food disappearance by the U.S. population.

o Food Consumption, Prices and Expenditures

The food supply data series was updated in FY 1989 in Food Consumption, Prices, and Expenditures, 1966-87 (FCPE), Statistical Bulletin No. 773, January 1989. FCPE is an annual publication. The data series was discussed and summarized in the National Food Review 1989 Yearbook: Food Beyond the Farm Gate and other USDA publications. The manuscript for Agricultural Handbook 671, Major Statistical Series of the U.S. Department of Agriculture, Volume 5: Consumption and Utilization of Agricultural Products was published in October 1989. This handbook describes the construction and use of annual series on per capita food consumption (disappearance), the index of per capita food consumption, and total food expenditures, which are included in FCPE.

o Long-Term Trends

Long-term trends in per capita, total food supplies are measured with a price-weighted per capita food consumption index based on 1982-84 = 100. Primarily, the index shows changes in quantity, although it also reflects shifts among major food categories such as the move from higher-priced beef to lower-priced poultry or from processed to fresh--particularly for fruits and vegetables. As measured by the index, per capita food supplies increased about 11 percent during the 1966 to 1987 period. More than half of the increase occurred during the last 4 years. A trend having significant nutrition implications is the steadily increasing importance of crop-derived foods compared to foods from animal products. In 1966, the index of food supplies from animal products exceeded the crop foods index by 7 percent. By 1987, the index of foods from crops exceeded the animal foods index by 5 percent. Over the 20-year period, crop-derived foods increased 18 percent while animal-based foods only increased 5 percent on a per capita basis. Consumption of most crop foods climbed steadily during the period, especially fats and oils, vegetables, grain products, sweeteners, and since 1985, fresh fruits. The increase for animal products has been moderated, however, by the declining use of red meat, eggs, fluid milk and cream, and animal fats.

o Omega-3 Fatty Acids in U.S. Food Supply Assessed

A special research project was conducted to assess for the first time the level and sources of omega-3 fatty acids in the U.S. food supply from 1935 through 1985. In recent years, possible benefits of omega-3 fatty acids have been recognized in the scientific literature. Omega-3 fatty acids are found in fish and in plants containing linolenic acid. The primary source of omega-3 fatty acids in the food supply is fish with fatty fish having the highest concentrations. Poultry also is a source, due to the inclusion of fish meal in the diets of commercially-raised poultry. Soybean oil, which contains linolenic acid, has also become a major source primarily due to its increased use.

o USDA Food Supply Series Fact Sheet

A fact sheet on the food supply was developed to provide health and nutrition professionals and researchers with an overview of the series. This fact sheet includes information on components of the food supply series, description and uses, as well as a selected list of references for further reading.

2. Household Food Consumption Surveys (HNIS)

a. Collecting and Reporting of Nationwide Survey Data (HNIS)

Survey activities were in five main areas: (1) completion of documentation and release of public use data tapes and reporting of descriptive tabular results from the Continuing Survey of Food Intakes by Individuals in 1985 and 1986; (2) supporting technical aspects of data processing and analysis and preparing for publication of results from the larger 1987-88 Nationwide Food Consumption Survey, including household food use and food costs and food intakes at home and away by individuals; (3) supporting technical aspects of launching the 1989 Continuing Survey of Food Intakes by Individuals and the follow-up Diet-Health Knowledge Survey including interviewer training, data collection, and processing; (4) planning for the 1990 Continuing Survey of Food Intakes by Individuals; and (5) planning for future activities conducted as part of the NNMS.

o Nationwide Food Consumption Survey (NFCS) 1987-88

The 1987-88 NFCS is the sixth decennial food consumption survey conducted by USDA since the first in 1935-36. Sample selection, data collection, and data processing were conducted under contract by National Analysts, Division of Booz, Allen, and Hamilton, Inc. according to HNIS specifications. The NFCS includes two components--household use and cost of food for a 7-day period (household component) and intake of food by individual household members for a 3-day period (individual component). Data collected include detailed information on food used by the entire household during a 7-day period, on the price paid for each food bought, and on the food each member ate over 3 days, both at home and away. Questions were also asked about demographic and socioeconomic characteristics of households and household members. The interviewers visited the household three times to collect information from participants: (1) an initial visit to identify respondents, describe the survey, and provide material for keeping notes on household food used during the survey period; (2) a personal interview 7 days later to conduct the household phase of the survey, to obtain a 1-day dietary recall from individual members of the household, and to leave a 2-day dietary record for individual household members to complete; and (3) a final visit 2 days later to review and collect the 2-day dietary record. Data collection began in April 1987 and was completed in August 1988. As well as monitoring all aspects of data processing, advance preparations for publication of results have been made to assist in release of a series of 21 statistical reports and popular chartbooks. New features in the reports include reporting data by sex/age groups that match those planned for DHHS's NHANES III; more extensive statistical reporting including analysis of the differences in intakes for all individuals by income, region, and race, and inclusion of standard error tables and cell size guidelines; and a breakdown of foods consumed as mixtures into their component parts (i.e., beef stew reported as beef, potatoes, carrots, etc.). Publications planned for 1987-88 NFCS include:

- Methodology publications that will contain detailed information on sample design and methodology of the survey. This information will be much more detailed than that provided in previous survey report appendices in response to requests from the scientific research community.

- Household publications that will contain statistical tables and brief discussion of data from the household component of the survey showing household food consumption and dietary levels.

- Individual intake publications that will contain statistical tables and brief discussion of data from the individual intake component of the survey for both 1-day and 3-day intakes.

- Popular chartbook publications that will present survey results in a chart-pictorial medium highlighting in nontechnical terms the general survey findings for the popular press and lay audience.

o Continuing Survey of Food Intakes by Individuals (CSFII) 1985 and 1986, and 1989 through 1996

The release of results (reports and data tapes) from the 1985 and 1986 CSFII was completed. The first results of the 1985 survey were released 6 months after data collection was completed; full release of all results was completed within 2 years after the completion of the 1986 data collection. This survey is the first nationwide dietary intake survey designed to be conducted year-by-year in this country. It was initiated following concerns expressed by two National Academy of Sciences' Committees and the President's Task Force on Food Assistance about the lack of recent data on the diets of the general population and subpopulations who may be at high nutritional risk. The results, which indicate several major changes in the food consumption patterns of individuals, have been useful to USDA and others in formulating and evaluating policies related to food production and marketing, food assistance programs, public health intervention programs, and dietary guidance.

The CSFII was reinstated in 1989 and is planned yearly through 1996. The data collection for the 1989 CSFII began in April 1989. The survey is designed to obtain 3 days of food intake data from all members of 1,500 households in the general population and on 750 additional households in the low-income population each year. Data reporting will be accomplished using a moving-average approach. This approach will provide annual 3-day estimates of dietary status for both men and women 20 to 49 years of age after 2 years of data collection beginning in 1990, with estimates for the other sex/age groups after 3, 4, or 5 years.

o Diet-Health Knowledge Survey (DHKS)

With the 1989 CSFII, a follow-up telephone survey is being conducted to assess the dietary knowledge and attitudes of survey participants. While the CSFII includes the collection of information on the food intakes of all household members, the DHKS is conducted with only the main meal-planner/preparer in the household. This survey is a cooperative effort between HNIS, Food Safety and Inspection Service, and DHHS's Food and Drug Administration. The two major purposes of the survey are to improve our understanding of factors that affect food choices, and to obtain information on people's knowledge and attitudes about the concepts promoted by the Dietary Guidelines for Americans. It represents the first time that a nationwide survey will be used to study the relationship between individuals' actual dietary intakes and their attitudes about dietary behavior. The DHKS is planned to be conducted each year as a telephone follow-up to the CSFII.

o National Nutrition Monitoring System (NNMS) Plans

USDA's system of Nationwide Food Consumption Surveys, including NFCS and CSFII, are major components of the NNMS. The Operational Plan for NNMS from 1987 to 1996 highlights plans for monitoring activities into the mid-1990's. USDA's role involves the following:

- Annual estimates of the food and nutrient content of U.S. per capita food supplies.

- Continuation of food composition research and measurements by HNIS and ARS.

- Continuation of maintaining, updating, and documenting food composition data files and food coding systems for use in NFCS, CSFII, and NHANES diet assessments.

- Reporting results from NFCS 1987-88, the 1989 and 1990 CSFII, and the 1989 DHKS in published reports and public use data tapes.

- Conducting CSFII in each year from 1989 until 1997 when the next decennial NFCS will be conducted.

- Conducting the DHKS as a follow-up telephone interview to the CSFII on consumers' knowledge, attitudes, and perceptions on diet/health issues.

o Second Report of National Nutrition Monitoring System (HNIS)

One of the goals of the Operational Plan for NNMS is the development of a system for reporting on the dietary and nutritional status of the U.S. population. USDA and DHHS have implemented a reporting system that integrates results of the monitoring system components into common reports. Two such reports have been sent to Congress--the first in 1986 and the second in 1989. The second report--Nutrition Monitoring in the United States: An Update Report on Nutrition Monitoring--provides updated information since the first report on the dietary and nutritional status of the U.S. population as well as factors that influence status. The report also includes an indepth analysis of the contributions of the NNMS in evaluating the relationship of dietary and nutritional factors in cardiovascular disease and in iron nutriture. This 436-page report published in September 1989 was prepared under contract at the request of USDA and DHHS with the Life Sciences Research Office, Federation of American Societies for Experimental Biology who established a nine-member Expert Panel on National Nutrition Monitoring. Data from USDA's Continuing Survey of Food Intakes by Individuals, Nationwide Food Consumption Survey, and U.S. Food Supply Series, are among the key sources of information in the report. Plans are underway for the third report.

b. Research on Food Intake and Survey Methods

HNIS maintains an active program in survey methods research. Since 1975, 12 major studies of survey methods have been completed by investigators at

universities or private research firms. These studies are documented in USDA Methodological Research for Large-Scale Dietary Intake Surveys, 1975-1988 published in 1989. This one-of-a-kind resource includes information on where survey methods were appropriate and where changes were needed. The following highlights survey methods changes based on this research:

- A 1-day recall method used in the 1965 NFCS survey was changed to a 3-day recall/record method in 1977-78 following completion of a study that showed that collection of 3 consecutive days of dietary intake data from each individual in sample households was a feasible approach for obtaining information about less frequently eaten foods and about day-to-day variation in food and nutrient intakes by individuals.

- Advance notice about surveys has been given to sample households following completion of a study that indicated this procedure would improve response rates.

- A study conducted prior to initiating the CSFII found that if the first day of intake data was collected in an in-person interview, the collection of subsequent days of intake data by telephone interview was a feasible approach. The same study found that mail survey approaches were unsuitable for national food consumption surveys.

- Probing by interviewers on often "forgotten" items in the form of a checklist was added to the CSFII and NFCS 1987-88 as a result of a study that showed that this procedure would improve data quality.

- A review of CSFII methodology found that panel surveys in which respondents were asked to provide six 1-day dietary recalls during one year as an indicator of "usual" intake had unacceptably high attrition rates throughout the year. Consequently, the CSFII methodology for 1989-1996 has been revised to drop the panel approach in favor of a 3-day recall/record.

- Collection of 3 days of intake was found to be less costly in time and funds if the days were consecutive rather than widely separated. Therefore, the panel approach in the CSFII 1985/86 has been changed to include 3 consecutive days of dietary intakes.

o Bridging Study Results Examined

Improvements and changes in survey methodology are made with each survey initiated based on methodology research results, past experiences, and needs of the survey. HNIS conducted the 1988 Bridging Study to serve as a "bridge" between the Nationwide Food Consumption Survey 1977-78 and the Nationwide Food Consumption Survey 1987-88, to assess the effect of procedural changes between the two surveys, and to facilitate the comparison of their results. A field experiment was conducted to test the effects of changes in interview and review procedures, food coding and gram weight conversion procedures, and nutrient data bases on estimated food and nutrient intakes. A split-sample approach was used; 697 women were randomly assigned to one of two treatment groups. For the most part, the effects of the various changes in survey

procedures were slight and tended to offset each other. Differences for iron, magnesium, and thiamin--the only three nutrients with significant univariate differences--could not be attributed to differences in interview or food coding procedures. Rather, they were primarily due to differences in the nutrient data base. Extramural research investigations on analytical procedures for food consumption survey data have been initiated.

o Estimating Distribution of Typical Intakes

C. Ritenbaugh, University of Arizona, is testing a newly developed procedure (called "unmixing") for estimating the distribution of true or "typical" intakes for cases where observed distribution was highly skewed and outlier-prone (such as vitamin A). The approach involves creating (simulating) a series of data bases from known distributions and testing the unmixing method on each, using different number of days, to determine conditions under which the method works well and its limitations.

o Within-Person Variation in Dietary Intake

G.H. Beaton, University of Toronto, is identifying the sources and nature of within-person variation in estimates of energy and nutrient intakes across time and implications for analysis of survey data. In this study, the ARS Beltsville longitudinal data set, which comprises one year of continuous dietary intake records for 29 men and women, will be analyzed to determine within-person variation, how it differs between persons, and whether it is characteristic of a person.

o Computerized Food Scale System for Dietary Intake Assessment

To determine if the American population is receiving adequate nutrition for health maintenance and disease prevention, accurate and efficient methods for measuring food intake are needed. NESSy, which is an acronym for Nutrition Evaluation Scale System, is a computerized system developed at WHNRC and designed to be used in the home for quantitative measurement of an individual's food intake. To evaluate the concept, design and accuracy of prototype systems, a validation study was conducted with nine women between 21-35 years. Food intake recorded by the women with NESSy was compared to that obtained from a weighted food record unobtrusively measured and recorded by trained dietary staff. The mean of the differences between NESSy and the manual technique was not significant on a group basis for food energy or any nutrient. For the majority of the individuals, accuracy within 10 percent of their actual dietary intake was found for energy and selected nutrients (i.e., fat, calcium, vitamin C, and vitamin A). Additionally, it was found that NESSy provided savings in time and labor of about 80 percent when compared to the manually weighed food record technique.

3. Determinants of Dietary Status Research (HNIS)

Research projects conducted through cooperative agreements with colleges and universities have analyzed CSFII 1985 and 1986 data to determine factors that influence dietary status. Findings from these investigations include:

o Relationship of Food Groups and Dietary Intake

Frances E. Thompson, Cornell University, examined which groups of foods are associated with total intake and with differences between individuals in intakes of fat, saturated fat, cholesterol, fiber, vitamin A, ascorbic acid, sodium, iron, and zinc -- nutrients which have been implicated as risk or protective factors for various chronic diseases. The results were used to determine which food groups account for differences in intake of a nutrient between individuals who have high intakes and those who have low intakes. Such food groups can be used to design food frequency questionnaires to classify individuals into categories of intake. In nutrition education messages, these food groups can also be targeted for increase or decrease as appropriate.

o Nutritional Quality of Diets of Population Groups in the USDA CSFII 1985

Carol T. Windham, Utah State University, used multiple regression and cluster analyses to identify the personal, demographic, and household factors associated with the intakes of nutrients and other food components, using data from CSFII 1985. Patterns of intake and factors associated with each pattern were identified. The factors most often distinguishing consumption patterns of women were size of the household, race, income, region, and education level of the male and female heads of the household. The role of "leader" nutrients in predicting adequate intake of "non-leader" nutrients and ratios of intra-individual to inter-individual variability were also examined.

o Changing Household Organization and Structure of Demand for Food in the U.S.

Ellen Bryant, et al., Mississippi State University, examined associations between personal, demographic, and household factors (particularly household structure) and eating patterns. The effects of these factors on food use and nutrient intake were assessed using a structural equation model. Women were more likely to skip meals than their 1 to 5-year-old children. Skipping any meals has detrimental effects on dietary intakes. Increased snacking had a positive effect on dietary intake. Unemployed women ate more meals at home, especially if they had children, as compared to employed women.

o 1987-88 NFCS Household Food Use and Individual Intake Studied

Six cooperative agreements have been awarded to research teams in five universities to analyze data from 1987-88 NFCS. Three research teams are analyzing data from the household portion of 1987-88 NFCS to determine factors affecting household food use and nutrient levels. This research involves 7 days of food use and food cost data by households for the general and low-income populations. Three research teams are analyzing data from the individual intake portion of 1987-88 NFCS to determine personal, household, and health-related factors and eating patterns associated with dietary status. This research involves 3 days of food and nutrient intake data by individuals living in households surveyed for the general and low-income populations. HNIS scientists are working cooperatively with investigators to

assure maximum coordination among investigators and usefulness of results to USDA, HNIS, and the fields of nutrition, public health, and agricultural economics.

Indepth analysis was conducted by HNIS scientists on a number of key issues related to food intake and dietary status using the 1985 and 1986 CSFII data. Findings from these investigations include:

- o Dietary Intakes by Employment Status

Data from the 1985 CSFII were used to compare food and nutrient intakes of women by employment status. Women employed full or part time, compared with women not employed outside the home, obtained greater proportions of their food energy and nutrients from food that was obtained and eaten away from home. In contrast, all groups of women had similar total mean intakes of most foods and nutrients and reported similar nutrient contributions from snacks.

- o Weight Status and Associated Factors of Women Assessed

Weight status was determined for women 19-50 years of age using the 1985 and 1986 CSFII. Demographic, socioeconomic, health-related, and dietary characteristics having a possible relationship to body weight were compared by weight status categories. Twice as many women (21%) were categorized as overweight as underweight (10%). Factors significantly associated with overweight were age, race, education, region of the country, occupation, household composition, self-assessed health status, physical leisure activity level, supplement usage, and smoking behavior.

- o Food and Nutrient Intakes of Pregnant and Lactating Women

Food and nutrient intakes of pregnant and lactating women were estimated using data from the 1985 and 1986 CSFII. Comparisons were made with intakes of nonpregnant and nonlactating women and with current recommendations. Pregnant and lactating women were more likely to use milk products, and lactating women were more likely to use fruit, than other women. Consumption of other foods was unrelated to physiological status. Absolute intakes of many nutrients were higher among pregnant and lactating women than among other women. However, except for some nutrients provided by milk products, nutrient intakes per 1,000 kcal were quite similar between pregnant and lactating women and other women. These results provide the only national estimates of food and nutrient intakes by pregnant and lactating women.

- o Food Grouping System Determines Ingredient Foods Used in Mixtures

Through a newly developed computerized system by HNIS that will separate foods such as beef stew and pizza into their individual ingredients, intake of food mixtures containing meat, poultry, or fish or grain products as the main ingredient was assessed. Results from CSFII 1985, 1 day showed that 38% of the weight of meat-based mixtures consumed by women 19 to 50 years, came from meat, poultry, or fish components, 26% from vegetables, and 13% from grains.

Grain ingredients comprised 34% of the weight of grain-based mixtures; vegetables, 23%; milk and cheese, 12%; and meat, poultry, or fish, 9%. Approximately 10% of these mixtures was water. When completed, the computerized Food Grouping System will permit separation of any type of food mixture into its component parts (ingredients or agricultural commodities) and allow easy and flexible regrouping of these food components.

o Food and Nutrient Intakes of Low-income Women and Children by Urbanization

Data from the 1985 and 1986 CSFII were used to analyze food and nutrient intakes by low-income women and children in two urbanization categories. The women and children were further classified by their household's participation or nonparticipation in the Food Stamp Program. Findings indicate that the diets of low-income women and their children living in nonmetropolitan areas were similar to those of low-income women and children living in metropolitan areas. The diets of women in both urbanization categories were similar regardless of their participation in the Food Stamp Program.

4. Nutritional Status Assessment Research

o New Techniques for Analysis of Folate

Methods were undertaken to identify the various forms of folacin as found, mixed together in foods or biological materials. Folacin standards were prepared containing various combinations of the various forms and used to test chromatographic separation techniques. Since the separation was incomplete, an additional procedure for identifying individual forms of folacin in a mixture was developed. This procedure is based on the differences between the various forms with respect to absorption of light at particular wavelengths. A newly available spectrophotometer called a diode array system, provided the means of distinction between the various forms. We can now determine the composition of this vitamin in practically every biological specimen at a rate of about 15-20 samples a week. Accomplishing the same task by the traditional methods is almost impossible. This technique aids in establishing the biologic values of folate in foods and adds to the data for use in calculating folate intake in national and local food consumption surveys.

o Bioelectrical Impedance Analysis of Body Composition

Bioelectrical impedance analysis is a new method that can be useful for assessment of human body composition. This approach is based upon the fact that when a radio-electrical frequency is applied to the body, it is conducted by fluids and salts that only exist outside of fat and bone. Some current applications of this method include estimation of the lean or fat-free component of the body, or the volume of water and its distribution in the body. Body fat can be calculated using estimates of fat-free weight and body weight. Errors in predicting these compartments do not exceed those of reference methods. A recent use of this method in clinical medicine is to predict the body cell mass or the energy requiring component of the body. Because this method is safe, inexpensive, portable, and easy to use, it has the potential for many uses in determining body composition of healthy individuals and of hospitalized patients.

o Assessment of Niacin Status

Niacin is required for many biochemical reactions, particularly for those involving energy production. Although pellagra, a disease resulting from deficiency of niacin, is no longer endemic in the U.S., better methods are needed to assess the occasional remaining cases of niacin deficiency, such as found in alcoholics and persons taking certain drugs, and to gauge the degree of marginal niacin deficiency in the U.S. population. Specifically, tests are needed that are sensitive to a small degree of body niacin depletion and which can be performed on blood rather than urine specimens. Hence, biochemical markers of niacin were investigated in healthy young men ingesting low, normal, or high levels of niacin while residing in a live-in metabolic unit for 11 weeks. We found that a ratio of red blood cell pyridine nucleotides (NAD to NADP) below 1.0 reliably indexes even marginal niacin depletion. This test now is the first blood test shown to be useful for assessing the niacin status of individuals or population groups.

o Evaluation of Vitamin K Status in Humans

Methods for the determination of vitamin K status in humans and in animals have been developed. One method measures the amount of vitamin K1 (phylloquinone) present in blood. The results obtained from measuring blood levels of vitamin K1 in a large population of young and elderly adults revealed that the amount of vitamin K in the blood is very, very low. Of the fat-soluble vitamins A, E, D, and K, vitamin K is present at the lowest concentration. Elderly people had higher levels of circulating fat and lower levels of vitamin K1 in blood than did younger adults and, therefore, may be at greater risk for developing subclinical vitamin K deficiency. Vitamin K is required to synthesize gamma-carboxyglutamic acid in several proteins involved in blood coagulation. When these proteins are broken down, the vitamin K dependent part of the proteins is excreted in the urine and can be monitored as an indicator of vitamin K status. A new method for the determination of gamma-carboxyglutamic acid in urine has been devised. The data indicate that this compound may be a good indicator of vitamin K status.

o Vitamin B-6 Deficiency Affects Sensory and Motor Function

Effects of severe malnutrition on behavior or function can be qualitatively obvious, but quantitation of subtle effects of diets marginally inadequate in specific nutrients is problematic. Marginal vitamin B-6 deficiency may be a concern in certain population groups in the U.S. Subtle abnormalities in motor function were detected in rats early in deficiency with hind leg gait analysis. In one experiment, width of step was significantly smaller in deficient adult rats, and a dose-responsiveness to dietary B-6 concentration was detected. Central nervous system "excitability" was evaluated with whole-body startle response to acoustic stimuli. This reflex is modulated by many of the same neurotransmitters as are affected in B-6 deficiency. Startle response was significantly affected as compared to pair-fed control rats. Sensory function was evaluated with hot water tail-flick. In a pair-feeding protocol with 4-hour meals, low-B-6 fed rats exhibited a prolonged tail-flick time as compared to controls. In rats fed 200 times the requirement of

vitamin B-6 for 6 weeks, a significant elevation in acoustic startle response was observed at Week 5, but grip-strength, width of step, and startle response were not different from control values. Thus, subtle functional deficits in vitamin B-6 deficiency can be detected and quantified in the absence of any clinical deficiency signs or any gross functional abnormalities evident on visual examination. Some of these same functions also can be evaluated quantitatively in humans.

o Improved Methods for Analysis of all Forms of Vitamin B-6

Several U.S. populations may consume inadequate amounts of vitamin B-6, according to the USDA National Food Consumption Survey of 1977-78 and the Continuing Survey of Food Intakes by Individuals, 1986. Until recently, assessment of vitamin B-6 nutritional status in humans has been made using methods that are cumbersome to perform, that may be insensitive to changes in marginal levels of vitamin B-6, or that detect only one of six forms of the vitamin that exist. To assess vitamin B-6 nutritional status accurately, investigators must be able to measure all six forms. An HPLC high performance liquid chromatography method for analysis of vitamin B-6 metabolites has been devised that is suitable for plasma, tissues, and urine. The method is based on modifications of the reverse-phase ion-pairing procedure and can be used to separate all forms of vitamin B-6 and metabolites in samples from laboratory animals and humans. The same group at WHNRC, San Francisco, California, also has developed an automated method to measure two sensitive vitamin B-6 dependent enzymes from red blood cells (erythrocyte alanine and aspartic aminotransferases). These enzymes show marked responses to small changes in vitamin B-6 intake and can be used as sensitive indicators of marginal or severe vitamin B-6 deficiency. These methods will permit investigators to better characterize vitamin B-6 nutritional requirements and metabolism in humans and laboratory animals using a single method that is capable of detecting all forms of the vitamin.

F. Food and Nutrition Information and Education Research

This research includes studies of dietary practices, food consumption patterns and their determinants (some described above) as well as studies of methods and strategies for informing and educating consumers and professionals who serve them about nutrition, health, and dietary practices.

1. Establishing Dietary Guidance Policy (HNIS)

o Campaign Launched To Increase Public Awareness of Dietary Guidelines for Americans

HNIS launched a new consumer nutrition education campaign called "Eating Right...The Dietary Guidelines Way." The purpose of the campaign is to increase awareness of the Dietary Guidelines for Americans and to help people put the Dietary Guidelines into action in their lives. The focus of initial campaign efforts is to reach the public with the Dietary Guidelines message through the media and other information multipliers, such as magazines, newspapers, radio, and television. The outreach is also targeted to professionals in the public and private sectors who interact with the public. The campaign kickoff was the release of four new consumer booklets containing practical advice for consumers when fixing quick meals, shopping for and preparing food, planning menus, making bag lunches, snacks and desserts and eating out. Press kits were sent to about 2,500 food editors of daily newspapers and major magazines nationwide. The kit includes the new booklets, feature releases, reproducible graphics and charts, and information about HNIS. Radio and television stations in about 10 major media markets across the country are being contacted for placement of campaign spokespersons to talk about campaign efforts.

o USDA's Dietary Change Research Model

Research using USDA's Dietary Change Research Model (formerly USDA's Practicality Assessment System) was conducted to assess change required in women's diets to meet nutritional recommendations made by the National Cholesterol Education Program Adult Treatment Panel, the National Institute of Health Consensus Development Conference on Osteoporosis, and the National Academy of Sciences Committee on Diet and Health. This model measures the magnitude and nature of dietary change required to meet nutritional recommendations set by authoritative groups as goals for the U.S. population. Information from the model is essential in dietary improvement. The HNIS scientist responsible for the model served as a technical resource to the NAS Committee on Dietary Guidelines Implementation. The modeling system and research results assessing dietary change needed to meet recommendations of the NAS's Report on Diet and Health were presented to the Committee as well as potential uses for USDA's modeling system in identifying implementation strategies for nutritional recommendations. By measuring the gap between current dietary intake and computer generated dietary patterns that will meet recommended intakes for any specific group, one can identify needed changes and barriers to change. For example, in a study using the diets of adult women, it was found that lean red meat was essential to render the diet adequate.

o Public Perception of Dietary Guidelines Bulletin Evaluated

A nutrition education research study is currently underway to determine the usability and understanding of nutrition information presented in the bulletin Dietary Guidelines for Americans by healthy American adults. This research is using qualitative evaluation methods including six focus groups and indepth interviews with 90 women to identify usability and comprehension of bulletin concepts. Preliminary results from the focus groups include the following recommendations: provide food group specific information with each guideline; define terms not commonly used, but frequently misunderstood, such as saturated fat; use more highlighted boxes and other typographic cues to identify important information; provide tips/suggestions on behavior change strategies; and consider adding menu suggestions and information about food labeling. Information from this research will be useful in revising the Dietary Guidelines for Americans publication and assisting the Dietary Guidelines Federal Advisory Committee in formulating the revised Dietary Guidelines.

o Diffusion Study on Dietary Guidelines for Americans

Since 1980, the Dietary Guidelines for Americans have been the focal point of Federal nutrition education for healthy Americans. To assess the national dissemination and impact of the Guidelines, HNIS and Extension Service, in cooperation with the University of Wisconsin-Madison, conducted a study of the roles of national, State, and local professionals in delivery of dietary guidelines materials and concepts to the public. A telephone survey was conducted with 300 national and State professionals representing 8 kinds of national and State gatekeepers in the communication and distribution process, and 178 nutrition education practitioners in local communities of various sizes. The study concluded that the simple presentation of high priority guidelines is an effective way of presenting nutrition information with the joint focus on seven major nutrition guidelines being well-received. The presentation of the Guidelines was viewed as most effective with professionals and other literate adult Americans. Each of the State and national groups included in the study played an important role in getting the message to local communities. Together they greatly multiplied the penetration and impact of the USDA/DHHS bulletin. Local respondents used these sources, as well as or in place of the government bulletin. Information about the Dietary Guidelines for Americans had reached most of the local practitioners included in this study. For future consideration, more emphasis needs to be given to materials that are likely to influence people to change behaviors, reach people through radio and television, and/or target selected groups appropriately. The Dietary Guidelines need to be kept constantly before the public. When there are no "new" messages, new ways of selling "old" messages must be devised.

o "Pattern for Daily Food Choices" Redesigned

A nutrition education research study to design and formatively evaluate a leaflet presenting USDA's food guidance system for healthy Americans "Pattern for Daily Food Choices" is underway. The study will use focus groups in

exploratory research to evaluate comprehension and perceived usefulness of the food guidance system. Prototype graphic layouts presenting key elements of the food guidance systems will be evaluated with target audience participants and nutrition educators. Prototype booklets featuring graphic representations and text describing how to use the food guidance systems are being prepared for evaluation by focus groups of adult household food managers and by nutrition educators.

2. Food and Nutrition Materials (HNIS)

Most materials developed in 1989 interpret concepts in the Dietary Guidelines and results from USDA research on food composition, food selection, handling and storage, and food money management. Target audiences are food and nutrition professionals, such as home economics teachers, Extension agents, and public health professionals who work with the general public, low-income groups, and consumers with special interest in food and nutrition. The following are materials developed and/or released in 1989.

o Consumer Booklets to Put Dietary Guidelines into Practice

Four new consumer booklets containing practical advice to help Americans put the Dietary Guidelines for Americans into practice. Their wording, design, and layout reflect responses from a series of reviews by focus groups and interviews with selected household food managers in shopping malls.

- Preparing Foods and Planning Menus Using the Dietary Guidelines provides the "hows" and "whys" of planning healthful menus within time constraints and family tastes. Includes checklists, menu makeovers, tips for cooking with less fat, sugars, and sodium, and 10 recipe ideas.

- Making Bag Lunches, Snacks, and Desserts Using the Dietary Guidelines gives ideas for creative bag lunches--hot and cold. A Muncher's Guide lists calories, fat, cholesterol, and sodium in favorite snacks and provides new snack ideas. Provides lots of tips for desserts with less fat and sugar and includes 27 recipe ideas.

- Shopping for Food and Making Meals in Minutes Using the Dietary Guidelines provides tips on reading labels and an aisle-by-aisle shopping guide of the supermarket. Helps tailor Guidelines-style meals to today's busy lifestyles and includes 18 timesaving recipe ideas.

- Eating Better When Eating Out Using the Dietary Guidelines provides hints on eating Guidelines-style away from home--from fast food to gourmet dining.

o Fact Sheets on Good Food Sources of Nutrients

A series of factsheets on good food sources of nutrients including nine vitamins, seven minerals, and dietary fiber were developed for consumers to help them select foods that contain adequate daily amounts of these nutrients as they follow the Dietary Guidelines. Each fact sheet includes information on the need for the nutrient, good food sources, and tips on how to prepare

foods to conserve the nutrients. Publication of the factsheets is planned for early 1990. An administrative report directed to professionals including nutrition educators, dietitians, and Cooperative Extension system home economists was published that includes tables of good food sources of nutrients and describes the criteria for determining which foods are good sources of a nutrient.

o Dietary Guidelines Poster

A Dietary Guidelines poster was developed for use in home economics classrooms. The poster supplements information in the Dietary Guidelines Teaching Kit designed for use in junior and senior high school home economics curricula. Forecast for the Home Economist, the leading professional magazine for more than 40,000 home economists who teach teens, served as the vehicle for distributing the poster. Additional copies were printed to make the poster available to those not receiving Forecast.

o Reaching Special Audiences with Dietary Guidelines Message

Three nutrition education research projects have been initiated to adapt and convey the Dietary Guidelines message to special target audiences. A cooperative project with the National Institute on Aging has been initiated to develop a bulletin or brief fact sheet series for healthy older adults on using the Dietary Guidelines for Americans. An interdisciplinary team of nutrition and reading specialists are being enlisted to identify and adapt information on 8 to 10 key topics to convey the Dietary Guidelines message to adults with low literacy skills. Adapted materials will be evaluated to determine comprehension, appeal, and perceived usefulness by the target audience. A cooperative effort with the Association for the Advancement of Health Education has been initiated to develop a teacher's guide to facilitate incorporation of Dietary Guidelines concepts into health education curricula for use by health education teachers.

o Cost of Food

The cost of food at home in food plans at four cost levels--thrifty, low-cost, moderate-cost, and liberal--was estimated and released monthly in press releases and other formats. The cost of food in the thrifty food plan for the 4-person household, which is used by the Department in setting benefits for the Food Stamp Program, increased 8.9 percent between June 1988 and June 1989.

3. Methodological Research

o Computerized Dietary Analysis as an Educational Tool

Extension Service and the Human Nutrition Information Service have entered into a joint project to evaluate the cooperatively developed USDA's Dietary Analysis Program (DAP). USDA's DAP is a software package that analyzes dietary intakes for up to 3 days and provides information on 28 nutrients and food components. The nutrients database used by the software consists of the

850 most commonly consumed foods from HNIS's most up-to-date available nutrient values--the USDA Nutrient Database for the 1987/88 Nationwide Food Consumption Survey. This database can be updated as the nutrient values change, adding a dimension of accuracy not common to other dietary analysis software packages.

The purpose of the joint ES/HNIS evaluation project is to determine the best educational use of USDA's DAP. Eight States are testing the software in various settings and with different audiences. Its use will be compared to other forms of program delivery to determine what impact individualized dietary evaluation has on audiences that are involved in nutrition education programs.

o Risk and Benefits of Food Systems Explored

Recognizing that consumers are concerned about the safety and wholesomeness of our food, Extension Service has initiated a set of pilot studies to evaluate various methods of delivering risk/benefit education to consumers, producers, processors, food handlers, etc. The ultimate message of these educational programs will be that our food system cannot be entirely risk free, but that through a responsible, scientifically-based system of evaluating risks and benefits, risks can be minimized to provide us with a safe, nutritious, inexpensive, varied food supply. In cooperation with the Food Safety and Inspection Service, Extension Service will be initiating the development and evaluation of various strategies to communicate basic concepts of food safety. The project will look specifically at use of agricultural chemicals and methods of safety of their use and the impact they have on the food system.

G. Research on Government Policies and Socioeconomic Factors

1. Studies on Food Prices, Expenditures, Food Safety and Consumer Demand

o Advertising and Demand for Cheese

ERS conducted research on the effects of advertising and promotion on the demand for cheese. During the 40-month period between September 1984 and June 1988, increased generic advertising by the National Dairy Promotion and Research Board and regional organizations of $203.3 million increased national at-home consumption of natural cheese by 19.5 million pounds and processed cheese by 179.1 million pounds.

o Food Expenditures

ERS updated research on the frequency of purchase of selected foods and changing patterns of household food expenditures to obtain a consistent data series for 1980 to 1986. Average weekly food expenditures in urban households rose from $18.94 per person in 1980 to $23.92 in 1986. Weekly spending per person for food consumed at home increased from $12.82 to $14.90 and from $6.11 to $9.03 for food consumed away from home. Total food spending was about the same after adjusting for rising prices.

o Concerns about Saturated Fat

Health concerns about "tropical oils"--palm oil, palm kernel oil, and coconut oil--in processed foods are receiving widespread attention. ERS analyzed the impacts of replacing tropical oils in foods. The U.S. used about 14.5 billion pounds of fats and oils in edible products in 1987/88. But only 550 million pounds, or 4 percent, were tropical oils. Several major food processing companies have eliminated tropical oils in all or most of their products, and other firms plan to follow. All cite consumer concern over saturated fats. Substitution is relatively easy in baking and frying fats, salad and cooking oils, and margarine. However, replacing tropical oils in such specialty applications as coffee whiteners, whipped toppings, confectionery products, and cracker spray coatings is more difficult because other oils don't have the same properties. ERS estimates that as much as half of the tropical oils in U.S. food products could be eliminated. Based on current consumption, this would be about 325 million pounds. If acceptable substitutes are found for specialty uses, even more could be eliminated. If edible use of tropical oils were cut 50 percent, the effect on U.S. fats and oils markets, U.S. imports, and world trade would be marginal.

o Food Safety and Technology

ERS conducted economic research on numerous food safety issues, including the costs of foodborne microbial diseases, the economic feasibility of food irradiators for controlling foodborne disease, and consumer willingness to pay for safer poultry products. These studies found that estimates of medical and lost productivity costs from bacterial foodborne illness were about $4.8 billion in 1987. The average cost per pound of irradiating food for electron

accelerator and cobalt-60 irradiators range from 0.5 to 7 cents per pound depending on the food and volume processed. Results from a recent survey found that consumers expressed a willingness to pay 17 to 21 cents per pound more for poultry products assured of having almost no chance of causing foodborne disease.

ERS commodity and international trade analysts periodically research the effects of food safety issues on domestic and world demand for food and U.S. trade. The July-September 1989 National Food Review: Investigating Food Safety focused on the following issues: The economics of food safety, consumer demand for safer foods, changing pesticide regulations, use and regulation of livestock hormones in the United States, the implications for international trade of the European ban on livestock hormones, and the U.S. effort to reform GATT's approach to health-related agricultural trade barriers. Other periodicals--Agriculture Outlook and Farmline--also feature ERS research findings.

ERS studied the economic impact of consumer health concerns about Alar on apples. Such concerns had a major impact on Washington red delicious apple prices during the 1988/89 season. When the media coverage on Alar intensified, f.o.b. prices in Washington declined sharply, deviating from what would have been expected, given usual seasonal price movements. The revenue loss for the Washington red delicious apple industry for the 1988/89 season is estimated at about $140 million. The f.o.b./retail price margin for red delicious apples rose, further exacerbating industry efforts to market the remaining apples in storage.

- o Environmental Concerns

Concerns about the environmental effects of fertilizer and pesticides have spurred interest in farming practices that cut fertilizer and pesticide use. USDA survey results suggest that lowered chemical input may lower per-unit cash production costs, and boost profits for some crop mixes in the Corn Belt. With the Environmental Protection Agency informally reviewing whether to allow farmers to continue to use soil fumigants, an ERS simulation study suggests that consumers would pay $3-$5 billion more annually in the short run for tomatoes, potatoes, and tobacco if fumigants were banned. In the short run, producers using fumigants would lose $100-$200 million annually, while those not using fumigants would be better off by $500-$800 million. Long-term effects would probably be smaller, as processors would contract for more acres of the affected crops and more would be imported.

2. Research Initiated

- o Evaluation of the San Diego Cash-Out Demonstration--Food Stamp Program

This project will evaluate the effects of cashing out food stamp benefits on household expenditures, food consumption, nutrient availability, program participation, and food retailers.

- Evaluation of the Alabama Pure Cash-out Demonstration - Food Stamp Program

The major focus of this evaluation is on the effects of issuing food benefits in cash on recipient household expenditures, food expenditures, food use, and nutritional availability. Randomly selected participant households in 12 counties will be cashed out. Their expenditure and food consumption patterns will be compared with data from randomly selected coupon recipients. Food consumption will be measured by a modified version of the Nationwide Food Consumption Survey (NFCS).

- A Study of Appropriate Methods of Drug Abuse Education in the WIC Program

This study, mandated by P.L. 100-690, will identify appropriate methods for the provision of drug abuse information and referrals in the WIC Program. It will have several products, including:

- a report to Congress identifying the problems caused by drug abuse during pregnancy and outlining approaches to working with the high-risk WIC population; and

- a resource guide that provides information to assist WIC professionals in their drug abuse information and referral activities.

- Process Evaluation of WIC Farmers' Market Coupon Demonstration Projects

An evaluation of 10 WIC farmers' market coupon demonstration projects will be conducted to assess their financial integrity and overall accountability. These 3-year projects, authorized by P.L. 100-435, provide coupons to WIC participants which may be used to purchase fresh produce at authorized farmers' markets. The process evaluation will emphasize project accountability, financial integrity of the coupon issuance and redemption system, and the basis for State matching funds. The results of the evaluation will contribute to a report to Congress at the end of the second year of project operations.

- WIC Program Child Impact Field Study

A contract was awarded in fiscal year 1989 to field test two different research designs for a WIC Child Impact Study--a study designed as a follow-up to the National WIC Evaluation which was completed in 1985 with a final report issued in 1986. This new effort will test data collection measures and procedures and obtain information on the development of children.

- FNS Elderly Feeding Study

The purpose of this study is to: (1) identify and describe the characteristics and nutritional needs of the low-income elderly, including projected trends, describe the key features of the Federal programs that provide food assistance served by these nutrition assistance programs; and

(2) evaluate how well the needs of the elderly are being served by USDA food assistance programs, according to the perceptions of elderly persons and others. This study commenced in November 1988; the final report was due September 1989.

- o Evaluation of the Food Distribution Program on Indian Reservations

This evaluation will examine the operations and effectiveness of the Food Distribution Program on Indian Reservations. A nationally representative sample will be interviewed regarding their use of, and preferences for, the commodities distributed, adequacy of household food supply, and nutrition-related health problems.

3. Research Highlights

- o UNC Design Feasibility Study - WIC Program

The purpose of this study was to assess the feasibility of a longitudinal study to determine the impact of WIC on infants and children. The final report of the study, completed in February 1989, concludes that such a study is feasible and recommended a study that would look at the impact of WIC on children from 6 months through 3 1/2 years of age.

- o Breastfeeding Promotion Study and Demonstration

The purpose of this study, which began in fiscal year 1987, is to identify, evaluate, and demonstrate educational models for effective breastfeeding promotion in the WIC program. These models will be used to provide technical assistance to State and local WIC agencies in their efforts to increase the proportion of WIC women who breastfeed. The study is currently in its final phase which involves the demonstration of breastfeeding promotion approaches at seven WIC local agencies in FY 1988-89. The purpose of the demonstration is to obtain information about start-up and maintenance of breastfeeding promotion models, information about breastfeeding incidence and duration, and information on barriers to breastfeeding and attempts to overcome them. The final report is due February 1990.

- o Study of WIC Participant and Program Characteristics

Public Law 99-500, enacted in 1986, requires USDA to submit a biennial report on WIC participant and program characteristics to Congress. To satisfy this requirement, USDA is implementing a system of gathering, analyzing and publishing WIC Program information. The information will include periodic descriptions of the characteristics of State and local agencies which operate the Program and periodic descriptions of the characteristics of individuals and families participating in the program. In July 1987, FNS awarded a contract to the Research Triangle Institute (RTI) to: (1) produce the 1989 report (PC 88); and (2) produce the 1991 report (PC90). RTI submitted a draft of the final PC88 Report to FNS for comment and is preparing the final report. Twenty-eight State agencies and 212 local agencies were selected to participate in the PC88 study.

- o The Supplemental Food Program for Women, Infants and Children (WIC) Analytic Research Projects

This FNS research focuses on a number of specific and ad hoc policy relevant analyses using data obtained primarily in 1984 for the WIC Participant Characteristics Study and the national WIC Evaluation. This research should expand present knowledge about the effectiveness of the WIC Program and provide more insight on program and participant characteristics. Examples of topics to be examined are characteristics of WIC households, the relationships between participant and Agency characteristics and the early enrollment of pregnant women, variation in costs of WIC food packages, and patterns of WIC participation.

- o Evaluation of the Impact on FNS Programs on Dietary Intake Using FNS' Four Day Files from the 1985 CSFII Survey

The purpose of this on-going project is to test state-of-the-art analytic techniques to estimate usual dietary intake and assess Food Stamp and WIC program impacts on individual nutrient intake. Measures on usual intake will be created with statistical procedures to create unbiased population estimates. Program impacts will be constructed using automated techniques to control for selection bias.

4. Other Research

- o Estimation of WIC Program Eligibility Study

According to the latest update of the study, WIC currently serves about 50 percent of those fully eligible. Almost one out of every three babies born in the United States is served by WIC. For those with incomes below the poverty level, over three-quarters of the eligible pregnant women and virtually all infants were served by WIC in 1986.

- o Evaluation of Prepared Meals Provision - Food Stamp Program

The Prepared Meals Provision study provided descriptive data on service providers for the homeless and homeless individuals who are service users. Highlights of the study findings of service providers suggest that 88% of them do offer meals; the majority of meals are served by shelters; and the meal quality is generally good and offers substantial variety. Findings from self-reported eating patterns of homeless individuals indicate that 63% eat two or more meals per day; 19% go without food one day per week; 17% go without food two or more days per week and some food groups are underrepresented, e.g., milk and milk products and fruits and vegetables.

- o Farmers Market Vegetable Crops

Vegetable crops have been introduced into several rural communities in the South as part of the growing effort to diversify and supplement farm incomes. Farmers in these localities organized vegetable marketing cooperatives to market their crops. The cooperatives improved their marketing, quality control, and procurement activities as a result of research information and

assistance provided by AMS in conjunction with ACS, Tennessee Valley Authority, various universities, and the Horticultural Producers Federation. The result of this project is expected to increase the variety of produce to rural consumers.

o Shiitake Mushrooms Grown in Virginia

AMS and the Virginia Polytechnic Institute and State University evaluated the physical distribution and marketing of Shiitake mushrooms grown in Virginia. The study included packing line operations, packaging, transportation, bacteriological and entomological information, in-store testing, and consumer acceptance. Shiitake mushrooms are one of the crops being tried to help Virginia farmers diversify their operations.

o Wholesale Food Center Growth Studied

AMS and the Maryland Food Center Authority completed a major study of the Maryland Wholesale Food Center in Jessup. A comparison of operating costs collected before and after construction of the 400-acre Center strongly illustrated the beneficial impact of modern food centers on helping hold down food marketing costs. This may also help to hold down costs to consumers. Total operating costs for produce firms decreased 39 percent on a per ton basis (adjusted for inflation) when compared with previous operations. Produce firms moving onto the Center from former downtown locations also expanded the geographical areas they served, increased volumes handled, and provided additional employment to the local economy.

III. NUTRITION EDUCATION AND INFORMATION PROGRAMS

The Human Nutrition Information Service coordinates Federal dietary guidance policy, develops research-based dietary guidance materials for the general public, and reports results from its research in food composition, food consumption, and nutrition education to professionals.

Nutrition, diet and health programs continue to be a major program emphasis within the Cooperative Extension Service. Each year, approximately 10-12 million people of all age groups and income levels participate in these educational programs. Four to five times this many are reached through mass media efforts. Approximately two million phone calls requesting nutrition, diet and health information are answered annually. In addition, approximately one-third of all 4-H members have food and nutrition projects. All 50 States and five territories support programs in nutrition, diet and health. They constitute approximately 45 percent of Extension's county home economics programming.

A. USDA's Responsibility to Assure That the Federal Government "Speaks With One Voice" When Issuing Dietary Guidance

1. Promotion of the Guidelines

HNIS initiated a new consumer nutrition education campaign called "Eating Right... The Dietary Guidelines Way." The purpose is to increase awareness of Dietary Guidelines for Americans and to help people put the Dietary Guidelines into action in their lives. The release of four new consumer booklets was the campaign kickoff. Copies of "Nutrition and Your Health: Dietary Guidelines for Americans," second edition, published by USDA and DHHS in 1985, continues to be available through the Consumer Information Center (CIC). The bulletin continues to be one of the most frequently requested publications from CIC. Also offered are camera-ready copies of the bulletin for reproduction by others. ES and HNIS conducted a study of users and uses of the bulletin and the concepts it presents. Results have been presented at major conferences of nutrition professional organizations.

2. Dietary Guidelines Advisory Committee Established

A Federal Dietary Guidelines Advisory Committee has been established by USDA and DHHS to review recent scientific evidence on diet/health relationships and determine if revision of the 1985 edition of Nutrition and Your Health: Dietary Guidelines for Americans is warranted. The nine-member Committee has determined that revision of the 1985 edition of the Dietary Guidelines is needed and are developing their recommendations to the Secretaries of USDA and DHHS and the rationale for them. These recommendations will be used by the two Departments to prepare a third edition of the Guidelines to be issued in 1990.

3. Uniformity within USDA

The Dietary Guidance Working Group of the Subcommittee for Human Nutrition, established in 1986, is responsible for reviewing all USDA publications and materials that contain dietary guidance information to help ensure that they accurately reflect USDA's food and nutrition policy as presented in the Dietary Guidelines for Americans and in the Secretary's Statement of USDA's Food and Nutrition Policy, that they are supported by research-based knowledge, that they are objective in presentation, and that they are supported across all agencies of USDA. The group is chaired by HNIS and includes representatives from nine USDA agencies--AMS, ARS, ERS, ES, FNIC, FNS, FSIS, HNIS and OGPA--and a liaison member from the DHHS.

4. Uniformity Among Departments

The Department continues to work with other agencies, especially DHHS in promoting uniformity of dietary guidance messages. For example, HNIS is represented on a DHHS Subcommittee on Dietary Guidance; on the Coordinating Committee for the National Cholesterol Education Program sponsored by the National Heart, Lung and Blood Institute; and on the Nutrition Objectives Working Group of the DHHS Year 2000 Health Objectives Committee. HNIS and DHHS's National Institute on Aging are working jointly to develop a bulletin on the nutrition needs of the elderly emphasizing the Dietary Guidelines.

5. Coordination With Private Sectors

HNIS has applied its unique computer modeling system--Dietary Change Research Model--to measure change that would be required in food consumption patterns to meet recommendations in the NAS's Diet and Health Report and presented this to the NAS's Committee on Dietary Guidelines Implementation. This model is intended for use with professional groups to solve mutual research problems. USDA has interpreted its research and dietary guidance policies for numerous commodity and trade associations who strive to develop products that meet consumer demands which are increasingly related to nutritional health issues as well as various private sector health promotion programs. HNIS serves as the USDA representative to Project LEAN, a national health promotion program sponsored by the Kaiser Family Foundation, designed to help Americans lower their intake of dietary fat. HNIS represents the Department on the Cooperating Group for a medical education program "Rx Nutrition Good Health In Practice" for the 67,000 primary care physicians nationwide. The American Red Cross 12-hour nutrition course, developed cooperatively with HNIS and ES, continues to be used in Red Cross Chapters nationwide to interpret the Dietary Guideline concepts in practical, interesting ways. This course has been shown through extensive evaluation to be successful in improving knowledge and food selection behavior. A Nutrition Education Task Force composed of government and industry representatives continues to meet quarterly under the direction of FDA with extensive participation by HNIS.

B. Programs Initiated or Expanded

1. Food and Nutrition Service Programs

o Resource Guide

The Food and Nutrition Information Center is updating The Nutrition Education Resource Guide: An Annotated Bibliography of Education Materials for the WIC and CSF Programs. This guide describes references and educational materials from a wide range of sources.

o Dangers of Drug Abuse During Pregnancy

During nutrition education sessions, WIC local agency professionals will inform WIC participants about the dangers of the use of alcohol, tobacco and other drugs during pregnancy.

o Public Service Campaign for Food Stamp Recipients

FNS, through a contract with the Ad Council, developed a public service campaign for Food Stamp recipients. The focus of this campaign was to promote the importance of good nutrition and its relationship to health. A nutrition booklet was developed that provides practical information on shopping, cooking, and eating habits for good health, as well as recipes. The campaign will run throughout 1989.

o Emphasis on Breastfeeding

FNS is continuing its ongoing efforts to promote breastfeeding in the WIC and CSF Programs through: developing publications; coordinating with other Federal agencies and private organizations; and funding breastfeeding education grants and demonstration projects.

o Nutrition Service Standards for WIC

Twelve nutrition services standards were jointly developed by FNS and WIC State agencies. These standards of practice were established to enhance the quality of nutrition services provided to WIC participants. The standards address aspects of both State and local agency operations, including WIC nutritional risk criteria, nutrition assessment procedures, nutrition education materials and counseling techniques, nutrition staff qualifications and training, and food package issues. State agencies use the standards to evaluate their own programs and identify areas needing improvement.

o Feeding Infants: A Guide for Use in the Child Care Food Program

This guide was developed by the FNS to feed infants who participate in the Child Care Food Program (CSFP). The infant feeding guide presents information on infant development, infant nutrition, safe food handling, and the infant meal pattern requirements for CSFP.

The guide was developed as an easy-to-read reference, covering both general feeding issues as well as specifics of the Child Care Food Program (CCFP) infant meal pattern. All foods included in the infant meal pattern are discussed in detail. The foods are grouped according to the method of feeding: Feeding by Bottle, Feeding of Solid Foods, and Drinking from a Cup.

The guide was designed to help the CCFP staff to disseminate information on infant feeding. The guide and appendix contain materials that can be easily reproduced and used as handouts.

o Quick and Easy Commodity Cooking

In cooperation with the Indian Health Service (DHHS), FNS has developed a commodity recipe book for participants of the Food Distribution Program on Indian Reservations. This recipe book is intended to enhance utilization of the program's food package by its participants and strengthen the incorporation of USDA/DHHS Dietary Guidelines principles into American Indian/Alaska Native food preparation habits and eating patterns.

2. Extension's Expanded Food and Nutrition Education Program (EFNEP)

EFNEP targets low-income families with small children and 4-H EFNEP youth, and through teaching, helps them acquire the knowledge, skills, attitudes, and changed behavior necessary to improve their diet. Families are taught a nutrition curriculum which includes the relationship of nutrition to health, how to prepare and serve nutritious meals, and management of food resources including food stamps.

During FY 1989, seven States received Federal funding for work on developing and testing cost-effective program delivery models with "preformed groups." "Preformed groups" were defined as individuals assembled or gathered for another purpose who were referred to or recruited by Extension personnel for receiving the EFNEP curriculum. Each State made arrangements with three public or private agencies or groups to locate eligible clientele, and provide assistance in making meeting arrangements, providing transportation or child care or other services. EFNEP paraprofessionals then taught the EFNEP curriculum to these groups. The cooperating agencies included: Food Stamp offices, WIC, Head Start, Young Families Program, a non-profit health clinic, Salvation Army, Community Action Agency, family shelters, a food pantry, Project Read literacy group and others. Typical audiences include: adolescent parents, pregnant teens, Indians on reservations, high school drop-outs, housing authority tenants and homeless families. It is anticipated that teaching preformed groups will be more cost-effective than recruiting and teaching individuals on a one-on-one basis. The results of these projects will be analyzed and effective models will be provided to States for replication.

Six additional projects were made possible by funding from the private sector to support program delivery innovation. Kraft, Inc. donated six $2,000 grants to focus on developing and using electronic media in program delivery and marketing strategies for recruitment and program support in EFNEP.

- Indiana's program will focus on nutrition education for pregnant women in response to that State's high infant mortality rate, and will feature training materials and videos as well as data collection instruments.

- Nevada will use their grant to provide interactive video instruction for EFNEP adults and pregnant teens. The project will result in increased nutrition knowledge for participants, with less staff time involved in teaching.

- Ohio's program will focus on development of interactive computer software curriculum to teach young people basic nutrition concepts. The software will be designed for classroom use with a potential audience of 5,000 youth statewide, with possible adaptation nationwide.

- Giving potential donors an opportunity to support the state-wide EFNEP youth program will be the focus of California's grant. Funding will be used to develop donor solicitation information tied to expanding EFNEP's outreach, especially in urban areas.

- In Tennessee, Extension personnel will recruit public housing residents to work with other residents and their children in nutrition education programs.

- Wyoming will use their grant to develop a self-study guide to complement nutrition curriculum videotapes. The guide will be tested in a controlled study and when finished will be adaptable for national use.

A 20th Anniversary of EFNEP celebration (partially funded by Kraft, Inc.) was conducted at USDA to recognize the program's accomplishments through the honoring of program participants, adults, youth, professionals and paraprofessionals from throughout the country. Similar program events were conducted in States throughout the year. These anniversary programs were designed to project the program into the future with renewed goals while recognizing its past accomplishments.

ARCO Foundation funded four projects for 4-H programs in Los Angeles, Seattle, Denver, and Dallas. These funds help model new ideas for expanding the scope and outreach of the 4-H EFNEP program, particularly related to the issues of youth and family nutrition, diet and health, and economic well-being.

Educational outreach: In FY 1988, nearly 557,000 persons participated in the program (187,000 families and 370,000 youth). Over 394,000 family members received benefits of the program as a result of adult participants being enrolled in EFNEP. The adult enrollee is the individual responsible for the family food preparation, and may be a female or male adult or a teenager of either gender.

Behavior change of adult participants is measured by 24-hour recalls taken at entry and exit to the program. These pre- and post-food recall scores show

that significant, measurable and documented changes take place in participants' diets.

3. Other Ongoing Nutrition Education Programs (ES)

Extension's nutrition, diet and health programs provide participants with education related to food safety and recommended lifestyle patterns including dietary practices as appropriate for clientele needs according to their age, sex, and stage of life. The "USDA/HHS Dietary Guidelines for Americans" and research findings serve as the bases for programs. Impact data from 1988 reports indicate that Extension programs emphasized increased knowledge of food safety issues, adoption of recommended food handling practices, and increased adoption of one or more of the Dietary Guidelines.

Some Example Programs:

o Cancer Risk Reduction Education Project

New Hampshire's major thrust "Cancer Risk Reduction Education Project" was enhanced with a $40,000 grant from the New Hampshire Division of Public Health Service. Almost 5,000 people were reached through direct contact and over 460,000 were reached through a major media effort.

o Culinary Hearts Program

The "Culinary Hearts Program" in Iowa instructed participants in how to read and interpret labels, and to prepare foods that help them implement one or more of the Dietary Guidelines. Impact data indicate that 78 percent of the participants cook with less fat, 67 percent eat more fruits and vegetables, 57 percent eat more fiber as a result of the program.

o Minimizing Health Risks

Colorado produced and tested a videotape and educational brochure to be used with both producer/processor and consumer groups. The materials focused on the application of risk analysis and on the degree of health protection and safety provided under alternative risk conditions. Governmental, industry and individual responsibilities in making informed choices and minimizing health risks were emphasized.

o Food Safety Education

Massachusetts developed and implemented a food safety education program for Senior Meal sites, family shelters, and Family Day Care Providers. Programs consisted of workshops, fact sheets, audiovisuals, teaching outlines, and training packets for county agents. Content included health risks associated with our food, safeguards in our food system, methods of reducing risk, economic benefits of safe food handling, and resources available to target populations to address further needs.

- o Safe Use of Agricultural Chemicals

New York designed and implemented a series of workshops that facilitated the interaction of participants including representatives from various sectors of the food system such as growers, wholesalers, retailers, regulators, chemical manufacturers, educators, nutritionists, and consumers. The focus of the workshop was on risk communication related to the broad issue of the residues of agricultural chemicals.

- o Reducing Risk of Microbial Contamination

Oregon developed publications and visuals targeted at three audiences--dairy, seafood, poultry, and deli meats producers; retail grocery personnel, including deli operators; and consumers. Emphasis was on delivery of educational programs to assess risks of Listeria contamination to increase clientele ability to make informed decisions which minimize those risks.

- o Managing Meals for Senior Citizens

"Managing Meals for 1 or 2" is a program developed by Florida Extension Service to teach elderly clientele planning and preparation techniques for nutritious meals. The program was delivered by volunteers to participants at senior citizens and meal sites. As a result, participants gained knowledge about nutrition and increased the variety of foods in their diet.

- o Foods of the Pacific Northwest

Oregon, Idaho, and Washington have cooperatively developed a 4-H curriculum titled "Foods of the Pacific Northwest." This series introduces young people to the foods produced in the Pacific Northwest and their use. It is estimated that this program will eventually reach an audience of 60,000, giving them the skills needed to use these foods in more healthful, creative ways.

- o Sports Nutrition for High School Athletes

Illinois has developed a series of video tapes and handout materials on sports nutrition for high school athletes. Funded in part by the Nutrition Education and Training Program, the series has been distributed to over 500 high schools throughout the State.

- o Pills Vs. Food Program

In cooperation with the Dairy and Nutrition Council of Indiana, Indiana CES developed a 2-hour program called "Pills vs Food." The objective of the program was to educate the public about the reasons and ways to get the nutrients they need from food rather than using vitamin/mineral pills or other supplements. The program was delivered to Extension homemaker volunteer leaders through the use of a statewide television system that allowed two-way verbal communication.

- o Reducing Risk of Cardiovascular Disease

Receiving a grant from the South Carolina Department of Health and Environmental Control, South Carolina Extension Service has developed a pilot project to try to reduce deaths and disability due to cardiovascular disease. Because of its high rate of cardiovascular disease, Florence, South Carolina was selected for the program. The program will emphasize the Dietary Guidelines and be delivered through group programs, home study courses, community demonstrations, and the media.

- o Minority Peer Education Program

Texas Extension Service is using an Administrative on Aging, Health and Human Services grant to develop a Minority Peer Education program. Blacks and Hispanics will teach nutrition and health lessons to other older adults at congregate meal sites.

- o Home Food Preservation

Home food preservation remains an important way in which to contribute to a family's economic and nutritional well-being. In Louisiana, low-income families developed home garden and food preservation plans to supplement their intakes of fruits, and green and yellow vegetables. In Missouri, EFNEP families produced an average of $386 worth of food which they probably would have done without had they not produced and preserved it themselves. Based on data from six States, nearly $5 million of produce were home preserved.

- o Master Food Preserver Program

Master Food Preserver (MFP) programs exist in many States. The objective of the MPF program is to train volunteers in the areas of food safety and home food preservation. Volunteers then return a minimum of 20 hours of time to their county office to answer phone calls, give demonstrations, maintain booths at farmers' markets, and to produce news and radio releases.

- o Food Safety and Home Food Preservation

In addition to the Master Food Preserver program, many of the States also conducted training for 4-H lay leaders, vocational home economists and other volunteers. Based on data from 13 States, 3,300 volunteers donated 70,350 hours to answer questions on food safety and home food preservation practices.

- o Food Safety Information Program

A wide variety of different approaches were used to teach appropriate food safety and food preservation practices. These included workshops, demonstrations, home study courses, newsletters, newspaper articles, radio and television spots and call-in shows, videotapes, hotlines, pamphlets, fact sheets, and other publications. Over 6.6 million clients were reached with food safety information, and 370,000 were reached with food preservation information.

o Training Family Day-Care Providers

To address the critical need for expanded child care facilities, a cooperative agreement will be initiated by the Cooperative Extension Service to integrate existing curricula and develop support materials to train Hispanic speaking, low literacy, and low-income adults the skills necessary to become licensed/registered family day care providers. The curriculum will include resource management, family life, nutrition, food safety, and health topics.

o Safe Food Handling Practices for Retail Food Operators

A project has been selected for funding by the Extension Service to develop a curriculum and training materials to teach safe food handling practices to retail food operators, especially those in the supermarket industry. The rapid expansion in the availability of refrigerated "takeout" foods from stores makes this a high priority for avoiding the microbiological contamination of food.

4. National Agricultural Library

The Food and Nutrition Information Center continues to serve as a source of nutrition information and educational resources for consumers, educators, researchers, and health professionals and food service managers.

o New Bibliographies/Information Products

NAL Quick Bibliographies have been developed on the following topics: food safety and sanitation audiovisuals, infant nutrition, adult nutrition education materials, preschool/daycare nutrition, and nutrition education materials: preschool through grade 12. Special Reference Briefs covering recent literature on food irradiation and worksite health promotion were also produced.

FNIC has received funding from the Food and Nutrition Service, USDA, to update the publication, Nutrition Education Resource Guide: An Annotated Bibliography of Educational Materials for the WIC and CSF Programs. Special features of this guide include evaluative appraisals and reading level analyses of each resource. Expected publication date is fall, 1990.

A new Pathfinder (a brief reading list of print and audiovisual resources) has been developed on the subject of food allergy, sensitivity and intolerance.

o Food Irradiation

Several major collections of early research reports on food irradiation have been donated to NAL. Because of the deteriorating condition of these reports--they are published on acidic paper which is rapidly disintegrating--NAL will utilize various new technologies to preserve and provide access to this valuable body of research. Initially, a limited number of selected reports will be electronically scanned to capture bit-mapped

images of each page. These images, along with a brief descriptive record for each document, will be stored and distributed on CD-ROM discs. Additional funding is being sought in order to complete processing of the most valuable parts of these collections.

o Promoting Nutrition through Education

An update of the publication Promoting Nutrition through Education: A Resource Guide to the Nutrition Education and Training Program (NET), has been completed. This volume contains food service training and nutrition education resources developed since 1984 with NET Program funding support.

Recently updated Pathfinder titles include: weight control, nutrition and cardiovascular disease, and nutrition and the elderly.

NAL has undertaken the evaluation of its collection in the area of food safety, concentrating on general contamination of foods by microbiological pathogens, toxic chemicals, or other environmental pollutants.

5. Commodity Education Programs

o Dairy Foods

ES-USDA worked with the National Dairy Promotion and Research Board on the development of educational resources for audiences in two age groups: people over 50 years old ("Dairy for the Prime of Life") and youth between 10-15 years of age ("Dairy Does a Body Good"). Multidisciplinary teams of Food and Nutrition Specialists, 4-H Youth Specialists, and field staff from 10 States provided input at the initial and subsequent stages of development. The video and supplementary materials emphasized the consumption of a variety of foods in moderation, exercise, and the role of dairy foods in the total diet. Approximately half of the States have submitted evaluations of the materials. The "Dairy Does a Body Good" program is being modified to extend usefulness to audiences such as the Future Homemakers of America and older 4-H groups.

o Lean Meats

Modules for the meat education program "The Consumers Choice--Lean Meat" are currently in draft form and undergoing revision. These modules are being written cooperatively by Food and Nutrition and Meat Science Specialists from three States--Florida, Kansas, and Texas. In addition, an advisory committee of 14 organizations has been assisting them with the module content. These organizations include commodity groups, nutrition professionals, and potential end users. Once the draft modules are revised, they will be pilot tested, printed, and distributed throughout the Extension System.

o AMS Uncouples Quality and Yield Grades

The official U.S. beef quality grades and slaughter cattle yield grades were uncoupled in April 1989. This means that the industry can grade beef for quality grade only, yield grade only, or both. The change will enable the industry to explore new technologies for producing leaner beef and removing unwanted fat prior to sale. The action resulted from a joint petition submitted to USDA by the American Meat Institute and the National Cattlemen's Association.

o AMS Grades More "USDA Select" Beef Since the Name Change

Since the beef grade "USDA Good" was renamed "USDA Select," there has been an increase in the amount of this beef graded by AMS. When the name change became effective in November 1987, USDA Good represented less than 2 percent of the total graded steer and heifer beef supply. By May 1989, USDA Select represented over 11 percent. AMS continues to respond to industry and press inquiries about the name change. The Select name has provided a more positive image for leaner beef, giving the industry an increased marketing opportunity to provide the leaner, less marbled beef that many consumers want today.

7. Graduate Fellowships Grants Program Activities - 1989

The U.S. Department of Agriculture Food and Agricultural Sciences National Needs Graduate Fellowships Grants Program was initiated in 1984 to attract academically outstanding scholars into advanced studies in the food and agricultural sciences. The program provides 3 years of training for a doctoral student and 2 years for a master's student in one of the following national needs shortage areas: food science/human nutrition; biotechnology; food, forest products, and agribusiness management and marketing; agricultural engineering; and water sciences.

The Fellowships Program has achieved a notable record and is proving to be an important part of the solution to the serious erosion of our scientific expertise. More than 400 fellows have participated in the program to date in prestigious graduate departments at both land-grant and nonland-grant universities. Twenty-five percent of the fellows have received support in the national need area of Food Science/Human Nutrition.

In FY 1989, almost $2.8 million were available to fund the program. There were 31 proposals submitted in Food Science/Human Nutrition, and FY 1989 Fellowships/Grants were awarded to the University of Florida ($144,000), North Carolina State University ($144,000), the University of California-Davis ($144,000), Michigan State University ($96,000) and the University of Illinois ($78,440). By December 1990, project directors at these institutions will select 14 doctoral fellows for 3 years of support.

IV. FUNDING LEVELS (1985-1990)

The expenditures for human nutrition research and human nutrition education and information by the several agencies in USDA for fiscal years 1985 through 1990 are summarized in Table 2. The Congressional appropriation for FY 1990 is also included. The total amount of human nutrition research support has increased from $52.3 million in fiscal year 1985 to $65.5 million in fiscal year 1990, an increase of 25.2 percent. During the same period, support for human nutrition education and information has increased from $133.6 to $167.8 million, an increase of 25.6 percent. The total support for human nutrition in the Congressional appropriation for FY 1990 is $233.3 million or 25.5 percent more than was expended in FY 1985.

Table 3 shows the amount of human nutrition research support within the Department for this period by subject area categories and agency. Slightly over half of the human nutrition research effort is focused on determining nutrient requirements/health maintenance at all stages of life. About one-sixth of the effort relates to the development of methods for measurement of nutritional status and collection of food consumption information. Approximately 1/6 of the funds are used to measure the content and bioavailability of nutrients in foods. The funds shown in the table do not include funds provided by the States or other sources and used in conjunction with those funds provided by the Cooperative State Research Service (CSRS).

Funds available for competitive research grants in human nutrition through CSRS were increased in the appropriation from $1.0 million in FY 1989 to $1.5 million in FY 1990.

Table 4 presents a breakdown of human nutrition education and information expenditures and budgets by subject category for the fiscal years 1985 through 1990.

A summary of actual expenditures, estimated support and the Congressional appropriation is given in Table 5 for the five Human Nutrition Research Centers and other Laboratories or Centers of the Agricultural Research Service (ARS) for fiscal year 1985 through fiscal year 1990. The net figure refers to funds to the location, while the gross amount includes overhead costs.

The Center at Tufts University in Boston is operated by ARS as a government-owned, contract-operated (GOCO) facility. The Center at Baylor College of Medicine in Houston is operated by ARS through a cooperative agreement.

Human nutrition research support at ARS Regional Research Centers and other Laboratories is shown in Table 6. These studies help to assure that problems and opportunities in human nutrition are considered in research directly related to the quality of the food supply.

Table 2

U.S. DEPARTMENT OF AGRICULTURE
HUMAN NUTRITION RESEARCH, EDUCATION AND INFORMATION
SUPPORT (FY 85-90)

HUMAN NUTRITION RESEARCH
($ in Millions)

	FY 1985 actual	FY 1986 actual	FY 1987 actual	FY 1988 actual	FY 1989 actual	FY 1990 estimate
ARS	36.9	37.8	40.6	44.3	45.7	47.9
CSRS	7.3	7.5	7.5	7.6	6.9	7.5
HNIS	6.0	12.8	6.1	7.1	7.7	7.9
ERS	0.7	1.1	1.2	1.0	0.9	0.9
FNS	1.4	1.5	0.5	0.5	0.6	1.3
TOTAL	52.3	60.8	55.9	60.5	61.8	65.5
Human Nutrition Education and Information						
ES	77.0	73.5	73.5	75.0	75.0	74.6
HNIS	0.7	1.2	0.7	1.2	1.1	1.1
FNS	55.0	57.6	60.4	65.5	71.6	91.3
FSIS	0.5	0.4	0.13	0.1	0.2	0.1
NAL	0.4	0.5	0.4	0.5	0.7	0.7
TOTAL	133.6	133.2	135.1	142.3	148.6	167.8
TOTAL RESEARCH, EDUCATION AND INFORMATION	185.9	194.0	191.0	202.8	210.4	233.3

Table 3

USDA NUTRITION RESEARCH PROGRAM SUPPORT (FY 85-90)
($ in Millions)

	FY 1985 actual	FY 1986 actual	FY 1987 actual	FY 1988 actual	FY 1989 actual	FY 1990 estimate
1. Nutrient Requirements/ Health Maintenance						
CSRS	4.6	3.9	4.6	4.2	4.0	4.4
ARS	26.3	27.5	29.9	31.0	33.3	37.7
Total	30.9	31.4	34.5	35.2	37.3	42.1
2. Nutritional Status/ Food Intake						
CSRS	1.4	1.7	1.3	1.8	1.3	1.3
ARS	2.3	3.1	3.9	3.9	4.0	2.5
HNIS	3.2	9.9	3.2	3.9	4.8	4.9
FNS	---	---	---	---	0.1	0.3
Total	6.9	14.7	8.4	9.6	10.2	9.0
3. Use of Food/Food Choices						
CSRS	0.3	0.2	0.2	0.2	0.3	0.3
HNIS	1.1	1.1	1.1	1.3	1.1	1.1
ERS	0.4	0.8	0.9	0.7	0.8	0.8
Total	1.8	2.1	2.2	2.2	2.2	2.2
4. Nutrient Composition/ Bioavailability						
CSRS	1.0	1.6	1.3	1.4	1.2	1.4
ARS	8.3	7.2	6.8	9.4	8.4	7.7
HNIS	1.7	1.8	1.8	1.9	1.8	1.9
Total	11.0	10.6	9.9	12.7	11.4	11.0
5. Nutritional Impacts of Programs						
CSRS	--	0.1	0.1	0.1	0.1	0.1
ERS	0.3	0.3	0.3	0.1	0.1	0.1
FNS	1.4	1.5	0.5	0.5	0.5	1.0
Total	1.7	1.9	0.9	0.7	0.7	1.2
TOTALS						
CSRS	7.3	7.5	7.5	7.7	6.9	7.5
ARS	36.9	37.8	40.6	44.3	45.7	47.9
HNIS	6.0	12.8	6.1	7.1	7.7	7.9
ERS	0.7	1.1	1.2	0.8	0.9	0.9
FNS	1.4	1.5	0.5	0.5	0.6	1.3
USDA Total Nutrition Research	52.3	60.8	55.9	60.4	61.8	65.5

Table 4

USDA FOOD AND NUTRITION EDUCATION AND INFORMATION SUPPORT (FY 85-90)
($ in Millions)

	FY 1985 actual	FY 1986 actual	FY 1987 actual	FY 1988 actual	FY 1989 actual	FY 1990 estimate
Extension Service[1/]						
Extension (Formula est.)	16.7	15.9	15.9	16.4	16.4	16.4
Expanded Food and Nutrition Education Program (EFNEP)	60.3	57.6	57.6	58.6	58.6	58.2
Total	77.0	73.5	73.5	75.0	75.0	74.6
National Agricultural Library						
Food, Nutrition and Human Ecology Staff	0.4	0.5	0.4	0.5	0.7	0.7
Human Nutrition Information Service						
Guidance and Education Research Branch	0.7	1.2	0.7	1.2	1.1	1.1
Food and Nutrition Service[1/]						
Nutrition Education & Training Program (NET)	5.0	5.0	5.0	5.0	5.0	5.0
Special Supplemental Food Program for Women, Infants and Children (WIC)[2/]	50.0	52.6	55.4	60.5	66.6	86.3
Total	55.0	57.6	60.4	65.5	71.6	91.3
Food Safety and Inspection Service						
Nutrition Labeling	0.1	0.1	0.1	0.1	0.1	0.1
Nutrition and Sodium Information*	0.1	0.1	0.02	0.0	0.0	0.0
Sodium Monitoring Program*	0.3	0.2	0.01	0.0	0.0	0.0
FDA/FSIS Labeling Consistency	--	--	--		0.1	0.0
Total	0.5	0.4	0.13	0.1	0.2	0.1
USDA Total Nutrition Education and Information	133.6	133.2	135.1	142.3	148.6	167.8

1/ Most funds are distributed to and managed by State agencies.

2/ Estimate of State administrative funds allocated for nutrition education.

*Programs discontinued

Table 5

AGRICULTURAL RESEARCH SERVICE
HUMAN NUTRITION RESEARCH SUPPORT (FY 1985-90)

Estimated Funds (In millions of dollars)

		FY 1985 actual	FY 1986 actual	FY 1987 actual	FY 1988 actual	FY 1989 actual	FY 1990 estimate
BHNRC, Beltsville, MD	Gross	8.00	7.91	8.34	8.42	8.12	8.27
	Net	7.30	7.02	7.41	7.35	7.31	7.48
GFHNRC, Grand Forks, ND	Gross	6.19	6.36	6.66	7.11	7.03	7.29
	Net	5.57	5.64	5.92	6.32	6.33	6.59
HNRCA, Boston, MA	Gross	11.35	11.75	12.76	13.68	14.06	14.26
	Net	10.79	11.16	12.12	12.99	13.35	13.54
CNRC, Houston, TX	Gross	3.59	4.43	5.43	7.65	9.07	10.43
	Net	3.23	3.93	4.88	6.99	8.34	9.63
WHNRC, San Francisco, CA	Gross	3.79	3.66	4.23	4.49	4.46	4.67
	Net	3.42	3.25	3.76	3.95	4.01	4.22
TOTAL, HN Centers	Gross	32.93	34.12	37.43	41.35	42.74	44.92
	Net	30.31	31.01	34.09	37.59	39.34	41.47
Other ARS HN Research	Gross	3.88	3.65	3.18	3.01	2.96	2.96
	Net	3.49	3.24	2.86	2.65	2.66	2.67
TOTAL, Human Nutrition	Gross	36.81	37.76	40.61	44.36	45.70	47.87
	Net	33.80	34.24	36.95	40.25	42.00	44.14

Table 6

AGRICULTURAL RESEARCH SERVICE

OTHER ARS HUMAN NUTRITION RESEARCH SUPPORT (FY 85-90)*
(In thousands of dollars)

		FY 1985 actual	FY 1986 actual	FY 1987 actual	FY 1988 actual	FY 1989 actual	FY 1990 estimate
Beltsville, MD	Gross	--	--	--	128.7	121.8	116.8
	Net	--	--	--	111.8	109.6	105.6
Ithaca, NY	Gross	551.5	601.3	750.9	765.0	755.4	743.0
	Net	496.6	533.5	675.9	676.0	679.7	671.8
Wyndmoor, PA	Gross	700.5	667.1	303.1	--	--	--
	Net	630.6	591.8	272.9	--	--	--
Peoria, IL	Gross	1,023.8	985.5	982.4	1,017.5	1,007.1	1,068.1
	Net	921.7	874.5	884.3	898.8	906.3	965.8
Albany, CA	Gross	1,007.9	959.2	712.7	653.8	493.0	483.9
	Net	907.5	851.0	641.5	576.3	443.6	437.6
Athens, GA	Gross	149.0	--	--	--	--	--
	Net	134.1	--	--	--	--	--
Hyattsville, MD	Gross	449.0	433.5	432.7	443.1	580.0	545.3
	Net	404.2	384.6	389.5	391.0	521.9	493.1
	Gross	3,881.7	3,646.6	3,181.8	3,008.1	2,957.3	2,957.1
	Net	3,494.7	3,235.6	2,864.1	2,653.9	2,661.1	2,673.9

* Excludes Human Nutrition Centers

V. COORDINATION AND ADVISORY MECHANISMS

A. Coordination within the Federal Sector

1. Interagency Committee on Human Nutrition Research (ICHNR)

The ICHNR continued to coordinate human nutrition activities at the Federal level with meetings of member departmental representatives at approximately 3-month intervals. Due to the change in administration, Dr. Charles Hess, Assistant Secretary for Science and Education, USDA, and Dr. James Mason, Assistant Secretary for Health, DHHS, replaced Drs. Orville Bentley and Robert Windom as cochairpersons.

The Fourth Conference for Federally-Supported Human Nutrition Research Units and Centers was held in Bethesda, Maryland, on February 15-16, 1987, under the auspices of the ICHNR. The conference involved 35 research presentations on two broad topics: Nutrition and Function and Nutrient Interactions and Toxicities. Ten papers were presented by ARS scientists.

2. Interagency Committee on Nutrition Monitoring (ICNM)

This Committee was established in 1988 in recognition of the need for strong, sustained and coordinated Federal efforts to monitor the nutritional status of the American people. Its purpose is to enhance the effectiveness and productivity of nutrition monitoring efforts by improving the planning, coordination, and communication among agencies engaged in nutrition monitoring. Co-chairs are the Assistant Secretary for Food and Consumer Services (USDA) and Assistant Secretary for Health (DHHS). Agencies represented include USDA's ARS, FNS, HNIS, and ERS; DHHS's NIH, FDA, NCHS, and CDC; Veterans Administration; Department of Defense; Agency for International Development; Census Bureau and Bureau of Labor Statistics. The Committee has published The Directory of Federal Nutrition Monitoring Activities which provides a descriptive summary of current monitoring surveys and activities. Working groups have been formed under the auspices of the Committee to address priority issues in the areas of survey complementarity, information dissemination and exchange, and food composition data.

3. USDA/DHHS Cooperation in Nutrition Monitoring

The HNIS/USDA and the National Center for Health Statistics (NCHS), DHHS, are continuing their joint coordination and collaboration in conducting the USDA Nationwide Food Consumption Survey and the NCHS National Health and Nutrition Examination Survey, the core surveys of the National Nutrition Monitoring System. Regular interagency working group meetings are held to coordinate survey planning and development of compatible systems. To facilitate expanded information exchange between USDA and DHHS, plans are being made to expand the interagency group to include other agencies in USDA and DHHS who use the data or have interests in nutrition monitoring. A joint HNIS/NCHS Nutrient Data Base Committee meets regularly to ensure continued development of compatible nutrient data systems for handling and coding nutrient data for dietary intake

surveys. This collaboration, as well as the joint publication of the Dietary Guidelines for Americans, is coordinated by the Assistant Secretaries for Health in DHHS and for Food and Consumer Services in USDA.

4. Second Report to Congress of the National Nutrition Monitoring System

This report, Nutrition Monitoring in the United States: An Update Report on Nutrition Monitoring was published in September 1989. A USDA/DHHS Joint Project Steering Committee defined the content of the report which includes an update on the dietary and nutritional status of the U.S. population based on data from the NNMS produced or released since the 1986 report and an indepth integrative analysis using NNMS data of two specific topics--nutrition factors in cardiovascular disease and assessment of iron nutriture. The scientific basis and review for the report was prepared under a USDA/DHHS contract with the Life Sciences Research Office of the Federation of American Societies of Experimental Biology (FASEB). A nine-member expert panel on nutrition monitoring was selected by FASEB from non-government sources representing a variety of disciplines including public health, epidemiology, nutrition, agriculture economics, behavior science, and statistics. The expert panel was responsible for the scientific basis and review of the report.

5. USDA and DHHS Cooperation on Diet-Health Knowledge Survey

Beginning in 1989, a telephone follow-up survey to the CSFII will be conducted each year for CSFII respondents who are the main meal planner/preparer of the household to assess their knowledge, attitudes, and perceptions concerning diet and health issues. This survey is the Diet-Health Knowledge Survey. It will be conducted each year that the CSFII is conducted. HNIS, FSIS, and DHHS' FDA worked collaboratively in planning and designing the 1989 survey.

6. DHHS National Health Objectives for the Year 2000

HNIS is representing USDA on the Nutrition Objectives Working Group of the DHHS National Health Objectives for the Year 2000 in order to promote uniformity between the Departments. Draft National Health Objectives for the Year 2000 were published by DHHS. As a member of the working group, HNIS will be involved in finalizing the Nutrition Objectives which are to be published in June 1990.

7. National Cholesterol Education Program

The Deputy Assistant Secretary for Food and Consumer Services, and more recently, HNIS, has provided USDA's liaison representative to the National Cholesterol Education Program (NCEP) Coordinating Committee. In this way the Committee was kept informed of USDA research results from food consumption surveys regarding dietary status and activities that are supportive of the Dietary Guidelines for Americans.

8. DHHS/Extension Service Cooperation

The Extension Service has been working closely with the National Heart, Lung and Blood Institute, National Cancer Institute, and National Cholesterol Education Program to facilitate the distribution of information and

educational materials throughout the Extension delivery network. Preliminary discussions with the National Cancer Institute and the Center for Disease Control indicate an interest in starting cooperative projects in FY 1990.

9. USDA and DHHS Cooperating to Promote Food Labeling Uniformity

HNIS and FSIS represent USDA in this project with FDA and DHHS's Office of Disease Prevention and Health Promotion. The first phase of the project, a contracted comparison of the legislative, regulatory, and case-law mandates for FDA and USDA food label regulations, will be completed this year. The second phase, development of options to improve food labels by a National Academy of Sciences panel, will be completed in the fall of 1990.

10. MOU Between ES and FDA

Extension Service and the Food and Drug Administration have signed a Memorandum of Understanding to establish the basis of increased cooperative programming. Staff from both agencies have been meeting to discuss potential areas of cooperation.

11. USDA-Food and Nutrition Services/Centers for Disease Control (CDC) Interagency Agreement Regarding Smoking Cessation in Pregnancy

During the project demonstration phase, CDC will develop, field test, and evaluate a package of smoking cessation and maintain interventions in collaboration with three States, and in consultation with FNS. Interventions will be provided in both prenatal clinic and WIC settings in the states of Missouri and Colorado and in prenatal clinics in Maryland. The agreement, which was signed in FY 1986, will remain in effect through FY 1991. In addition, this agreement will expand the capabilities of the CDC Patient Flow Analysis System by promoting development and dissemination of WIC compatible patient flow analysis simulation software for microcomputers.

12. Joint USDA/DHHS Effort on Lactation Management

In fiscal years 1989 and 1990, the focus of a joint FNS and DHHS, Office of Maternal and Child Health (OMCH) effort is in the area of continuing education in lactation management. WIC personnel are invited to participate in lactation management. WIC personnel are invited to participate in 10 regional conferences supported by OMCH through a training grant to the University of California-San Diego; USDA is providing funding for several additional conferences through an interagency agreement with OMCH.

13. Interagency Agreement for Drug Abuse Coordination

FNS has entered into an interagency agreement with the Office for Substance Abuse Prevention (OSAP), Alcohol, Drug Abuse and Mental Health Administration (ADAMHS), DHHS, to establish a formal mechanism for coordinating WIC's activities related to drug abuse information and referrals. Its objective is to improve the provision of services to pregnant and postpartum women and infants particularly through drug abuse information and referrals.

14. Interagency Ad Hoc Committee on Health Promotion Through Schools

Representatives from appropriate agencies in seven Federal government departments currently participate on this committee which meets regularly to exchange information and to foster coordination of efforts on activities related to health promotion through schools. The U.S. Department of Agriculture sends representatives from the Food and Nutrition Service, Human Nutrition Information Service, and the National Agricultural Library.

15. USDA/DHHS Nutrition Education Committee for Maternal and Child Nutrition Publications

In response to a need for a mechanism for a joint effort on nutrition education materials related to pregnancy and infant care, the Assistant Secretary for Health, DHHS, and the Assistant Secretary for Food and Consumer Services, USDA, established the USDA/DHHS Nutrition Education Committee for Maternal and Child Nutrition Publications in November 1980. The committee serves as a systematic mechanism for agencies within USDA and DHHS to report their plans and progress related to maternal and child nutrition education in an effort to avoid duplication and make more effective use of resources. An FNS staff member serves as Department coordinator for this joint effort.

16. USDA/FDA Public Awareness Campaign about Eggs

AMS distributed over 50,000 Safe Egg-Handling bulletins as part of a public awareness campaign aimed at high-risk populations and the food service establishments that serve them. The bulletins were developed cooperatively by AMS, APHIS, FSIS, and FDA in response to the emergence of Salmonella enteritidis in table eggs.

17. Label Harmonization Task Force

The Department of Agriculture and the Department of Health and Human Services have formed a joint task force to recommend a uniform and effective standard for displaying nutrition-related information on food labels in the United States. This effort is in response to recommendations from recent reports, including the Surgeon General's Report on Nutrition and Health and the two National Academy of Sciences' reports entitled Designing Foods and Diet and Health: Implications for Reducing Chronic Disease Risk. These reports emphasized the importance of providing consumers with nutrition information that will allow them to make informed dietary decisions.

This work will be done through contract in two parts. Part I will provide a detailed analysis of authorizing legislation, regulation, policy statements, and enforcement guidelines which form the basis for current Federal policies on food labeling in the United States. In addition, it will provide a summary of international agreements that could be relevant to domestic policy on food labeling in the near future. Part II will (1) integrate the latest consensus on the science of nutrition and health, the current state-of-the-art of health communication, and the existing legal, regulatory, and policy basis for food labeling in a thorough, critical review; and (2) provide options for improving food labeling policy that will enhance the ability of consumers to choose healthy diets. The focus will be principally on nutrition labeling, ingredient labeling, and descriptive terms such as "high" or "reduced" for calories, sodium, cholesterol, etc.

B. Coordination Within USDA

1. Subcommittee for Human Nutrition

The Subcommittee for Human Nutrition of the Department's Research and Education Committee meets at monthly intervals. It serves as the primary mechanism for coordination of human nutrition activities in USDA. It has met regularly with monthly meetings of representatives from those USDA agencies involved and liaison members from DHHS, NIH, and Industry groups. The Subcommittee provides the mechanism for regular information exchange and discussion and planning on human nutrition policy issues. The Subcommittee also serves as the vehicle for the implementation of cooperative program activities. For example, this report was prepared through the Subcommittee.

2. Dietary Guidance Working Group

The Dietary Guidance Working Group, formed under the Subcommittee for Human Nutrition in 1986, continues to review all publications, including prospectuses and publication drafts, presenting dietary guidance information. The review process is thorough and timely for ensuring that guidance conforms to the Dietary Guidelines and is consistent and supportive across USDA agencies and the Federal Government. The group composed of representatives from nine USDA agencies and a DHHS liaison, also serves as a means of communication among nutrition education specialists in the USDA agencies that provide guidance to their respective clientele.

3. FNS and HNIS Cooperation on Standards

FNS and HNIS cooperate in the development of certain food assistance program standards, such as the thrifty food plan for establishing benefits in the Food Stamp Program and meal patterns for measuring compliance in the National School Lunch Program. HNIS-generated data bases on food composition and food consumption and prices are used in developing the standards.

4. HNIS and ERS Cooperation on Food Supply Data

ERS and HNIS cooperate in estimating and publishing information on trends in the nutrient content of U.S. food supplies.

5. MOU Between ES and HNIS

A Memorandum of Understanding between ES and HNIS has expanded and clarified the intentions of the two agencies to work together in achieving their common goals in nutrition education. A Cooperative Extension System/Extension Service/HNIS Consulting Group was formed to advise HNIS staff concerning their future nutrition education needs. This Group meets quarterly through teleconferences or face-to-face meetings to facilitate communications. One of the major projects conducted jointly by HNIS and ES was development of a dietary analysis software package for the personal computer. ES and HNIS are cooperating in evaluating use of the software in a variety of Extension System programs.

6. FSIS/ES Cooperative Efforts

Extension Service and the Food Safety and Inspection Service are jointly administering a project to evaluate public awareness strategies to address concerns about chemicals and the food supply. The Environmental Protection Agency and Food and Drug Administration will also be involved in an advisory capacity. A Cooperative Extension Service consulting group has been established to provide input and feedback for future FSIS consumer education projects.

7. FNIC and USDA Agencies

FNIC provides comprehensive reference/research support and direct lending services to the U.S. Congress, Federal Government agencies, and libraries and information centers. Through an interagency agreement with the Food and Nutrition Service, USDA, user categories eligible for unrestricted services have been expanded to include cooperators with FNS programs. Others may obtain FNIC materials through interlibrary loan; comprehensive reference assistance is available on a cost recovery basis. A large collection of nutrition software is also available for preview at NAL.

8. Cooperative Regional Research Projects (CSRS)

The Cooperative State Research Service administers and funds cooperative human nutrition research involving land grant institutions and the 1890 colleges and universities. These projects are regional and may involve ARS scientists. The active regional projects in human nutrition are listed:

- o Western Regional Research Project (W-143) - Nutrient Bioavailability--A Key to Human Nutrition

Our understanding of the dietary factors that affect the digestion and absorption of available form of nutrients, especially vitamins and minerals, is limited. Since some of the nutrients (iron, pyridoxine, calcium, folacin) most affected appear to be marginal or low in diets of certain population subgroups, data on bioavailability becomes of critical importance in establishing sound dietary requirements as well as appraising dietary adequacy. This project involves ten universities and the Western Human Nutrition Research Center.

- o Northeast Cooperative Regional Research Project (NE-147)--Improving Sensitivity of Methods to Assess Nutrient Intake and Predict Nutritional Risk (terminated in FY 1989)

Dietary intake data are a critical link in the chain of measurements needed to evaluate and monitor nutritional status and to identify ways to improve diets. Individual assessment is a basic component of programs designed to initiate and monitor changes in food intake and food habits. This study involved eight institutions with a focus on ways to reduce errors in collection of dietary intake data.

- o Western Cooperative Regional Research Project (W-153)--Economic and Behavioral Factors Associated with Food Supplement Usage

The objectives of this project are (1) to identify attitudes and economic factors which result in the use of food supplements and (2) to determine if a relationship exists between health attitudes and intentions and actual vitamin/mineral supplementation behavior.

- o North Central Cooperative Regional Research Project (NC-167)--Health Maintenance Aspects of Dietary Recommendations Designed to Modify Lipid Metabolism

The objectives of this project are (1) to determine the effects of dietary omega-3/omega-6/omega-9 fatty acid ratios on physiological factors in humans and experimental animals; (2) to evaluate the effects of caloric intake, expenditure distribution, and dilution on serum lipid levels, metabolism, blood response, and body composition; and (3) to assess the effects of varying levels of dietary minerals on blood lipoproteins. This study involves collaboration among 10 different universities and two ARS centers.

- o Northeast Cooperative Regional Research Project (NE-172) Nutritional Assessment of Older Americans: Diet Intake and Biochemical Studies (initiated in FY 1989)

The objectives of this regional project are to (1) assess the validity of methods of determining food intake and study factors affecting food intake in older adults; (2) evaluate biochemical methods for measuring iron, magnesium, protein and amino acid status of older adults; and (3) compare and integrate biological, cultural and sociological measurements as indices of nutritional status in the elderly. This project was designed by researchers from 9 states, and one ARS center.

- o North Central Cooperative Regional Research Project (NC-173)--Communication Strategies to Improve Nutritional Practices of Adolescents (terminated FY 1989)

The goal of this project is to design communication strategies which are effective and feasible for motivating adolescents to make optimal dietary choices. Nutrient orientation and problems of adolescents are considered, such as their interest in sports and athletics, high incidence of pregnancy, common occurrence of iron deficiency anemia, concern with body image, high incidence of obesity, and occurrence of anorexia nervosa.

9. Human Nutrition Subcommittee of the Experiment Stations Committee on Programs and Policy (ESCOP)

The purpose of this subcommittee is to identify human nutrition research needs and any policy issues which may relate to these needs (i.e., training, equipment, available resources) and to make recommendations to ESCOP. The subcommittee also serves an important role in communication with related groups, and has liaison members meet with it from CSRS, HNIS, ARS, and other agencies.

C. Coordination with the Private Sector

1. Committee on Dietary Guidelines Implementation

The Food and Nutrition Board of the National Academy of Sciences initiated a study on implementing dietary guidelines. The two major goals of the study are to propose detailed strategies and options for the implementation of dietary guidelines by the various groups and organizations that have issued them, and to examine potential benefits and costs of implementation. At the request of the Committee, USDA provided an extensive summary of our multi-faceted program to promote and implement the Dietary Guidelines for Americans. An HNIS staff person is serving as a resource person to the Committee regarding USDA's Dietary Research Change Model (formerly Practicality Assessment System).

2. Committee on Nutritional Status During Pregnancy and Lactation

This National Academy of Sciences Committee is evaluating and documenting the current scientific evidence and will propose recommendations pertaining to dietary intake and nutritional status during pregnancy and lactation. HNIS has provided the Committee with information about USDA food consumption survey data relative to pregnant and lactating women.

3. ARS Nutrition Composition Laboratory and HNIS Nutrient Data Research

There continues to be a very close working relationship and interaction between the ARS Nutrition Composition Laboratory (NCL) and the HNIS Nutrient Data Research Branch in planning and conducting food composition studies and in compiling and documenting results. NCL distributes and evaluates test sample analyses as part of HNIS contractor selection process for food composition analyses. NCL and HNIS are part of an international collaborative research study evaluating methods of dietary fiber analysis being conducted in laboratories in the United Kingdom, Canada, and the United States.

4. ES Meat Project Advisory Committee

The ES meat education project "The Consumer's Choice...Lean Meat" has been developed in cooperation with 14 organizations including industry, health organizations, and government representatives.

5. FNIC and American Dietetic Association Foundation

FNIC is currently working with the American Dietetic Association Foundation on an agreement to coordinate and prevent duplication of services planned through the Foundation's National Center for Nutrition and Dietetics.

6. American School Food Service Association and FNIC

The American School Food Service Association (ASFSA) will be cooperating with FNIC to review and strengthen the Center's collection of food service

management resources. Additional mechanisms to assist ASFSA members in their efforts to achieve certification and professional development goals are also being jointly explored.

7. Industry-Financed Research and Promotion Programs

A new industry-financed research and promotion order for watermelons was issued in July 1989. This program along with those for potatoes, eggs, dairy, beef, pork, and honey are authorized by Federal statute and fall under AMS' oversight responsibility.

8. ARS/Industry Workshop--Human Studies on Dietary Fatty Acids

The Agricultural Research Service (ARS) convened scientists from industry, National Institutes of Health and ARS on July 25, 1989, to exchange information about the recent progress of research on the effects of dietary fats and fatty acids in human subjects, and to examine the fatty acid research questions of importance to the food industry in order to identify those of greatest importance.

Although each participant was left to summarize the outcome of the workshop, there seemed to be agreement on the following:

- High priority should be given to determine the extent to which stearic acid is absorbed; the rate it is converted to oleic acid and its effect on prostaglandins, platelets and enhanced blood clotting.

- It is appropriate to confirm the effect of palmitic acid and other saturated fatty acids on chronic disease risk factors.

- More attention is needed to determine the desirable level of "saturated fatty acids" and fat level in diets for adult humans. Certainly more research is needed about effect of fatty acids on risk factors for children over 2 years of age.

- More information is needed about the factors that influence the conversion of linoleic and linolenic acids to longer chain polyunsaturated metabolites.

- Although many questions still remain about the effects on trans versus cis fatty acids on risk factors, studies in this area are not considered to be high priority by at least some of the industry participants.

D. Advisory Groups

1. Human Nutrition Board of Scientific Counselors (HNBSC)

Resolutions passed by the USDA-HNBSC at their annual meeting on April 26-27, 1989, are listed:

o Resolution 1, Relating to Nutrition Monitoring:

Resolved that the Human Nutrition Board of Scientific Counselors urges the Secretary of Agriculture to support legislation that will:

-- Establish a plan for a National Nutrition Monitoring System (NNMS);

-- Provide a mechanism for interdepartmental coordination of the various parts of the NNMS;

-- Provide for cooperation between the NNMS and State systems for nutrition monitoring; and

-- Provide a mechanism whereby nutrition guidance for the general population proposed by a Federal agency will be reviewed by the Secretaries of Agriculture and Health and Human Services before its release--a mechanism which will allow for public review and comment of that guidance; and which will not prevent the release of nutrition guidance after appropriate review if it is deemed necessary and appropriate by the responsible Federal agency.

o Resolution 2, Relating to Competitive Grants in Human Nutrition:

Resolved that the Human Nutrition Board of Scientific Counselors renew its advice to the Secretary that he continue to strongly support the human nutrition program of competitive research grants.

o Resolution 3, Relating to New Human Nutrition Research Facilities at Beltsville:

Resolved that the Human Nutrition Board of Scientific Counselors, having previously visited the Beltsville Human Nutrition Research Center and evaluated its programs and facilities, urges the Secretary to include in Fiscal Year 1991 budget request funds for planning a new facility for human nutrition research at Beltsville in cooperation with the National Institutes of Health.

o Resolution 4, Relating to Priorities in Collection of Food Consumption Data:

Resolved that the Human Nutrition Board of Scientific Counselors express its support for increased priority in food consumption data collection on aging Americans and other populations at nutritional risk.

- o Resolution 5, Relating to Need for Manpower Trained in Human Nutrition:

Resolved that in view of the increased awareness of the diet and health issue and the need for trained manpower, the Human Nutrition Board of Scientific Counselors express its support of the USDA Food and Agriculture's Sciences National Needs Graduate Fellowship Grants Program in the area of human nutrition.

- o Resolution 6, Relating to Expression of Appreciation for Assistant Secretary Bentley:

Resolved that the Human Nutrition Board of Scientific Counselors express appreciation to Assistant Secretary Orville G. Bentley for his expert leadership in the area of the mission of the Board.

- o Resolution 7, Relating to Interagency Cooperation in Food Labeling:

Resolved that the Human Nutrition Board of Scientific Counselors commend the increased interagency cooperation between the Food Safety and Inspection Service, USDA, and the Food and Drug Administration, DHHS, in food labeling and encourage increased industry involvement in the planning of any proposed changes.

In addition, the Board requested that a letter be sent to the Secretary requesting that the discontinued portions of the Crop Estimating Program by the National Agricultural Statistics Service be reinstated in order to provide information on fruit and vegetable production and use for nutrition monitoring purposes.

2. National Advisory Council on Maternal, Infant and Fetal Nutrition

The National Advisory Council on Maternal, Infant and Fetal Nutrition made the following recommendations in its 1988 Biennial Report to the President and Congress concerning the WIC Program:

- o It was recommended that WIC regulations specifying maximum monthly allotments of special formulas for participants with certain medical conditions be changed to allow for the provision of additional amounts of prescribed formula, when nutritionally or medically indicated.

- o It was recommended that when USDA reexamines the WIC and CSFP food packages for possible modification, consideration be given to adding additional foods to the package for older infants.

- o It was recommended that USDA require each WIC and CSFP State agency to include in its annual State plan of operation and administration specific coordination procedures to reach and serve children with special health care needs.

3. Dietary Guidelines Advisory Committee

A Federal Dietary Guidelines Advisory Committee established by USDA and DHHS to review recent scientific evidence on diet/health relationships determined that revision of the 1985 edition of Nutrition and Your Health: Dietary Guidelines for Americans was warranted. The nine-member Committee is developing their recommendations for revision and the rationale for them. These recommendations will be used by USDA and DHHS to prepare a third edition of the Guidelines to be issued in 1990.

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